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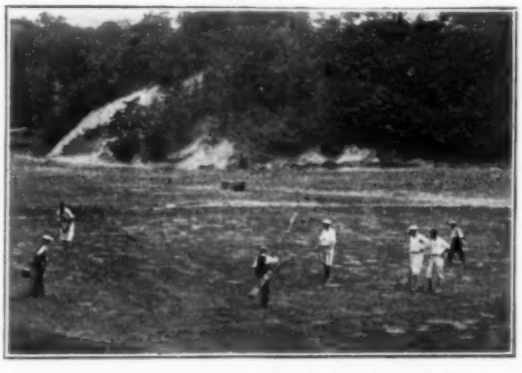
Beating Col. Bogey With Cast Clubs

FROM the time when the first robin appears in spring to the early snowstorm of winter, thousands of Americans flock to the golf courses throughout the country to enjoy a game which appears to rival baseball in popularity. The rapidly increasing number of people playing this game may be attributed to numerous causes, such as the much needed exercise for the tired business man, the volume of free advertising that the game has received, or the opportunity presented the devotee to relate the harrowing tales of his trip over the fairway in the realistic manner formerly reserved exclusively for fishermen. It is estimated that between 3000 and 4000 clubs maintained golf courses in the United States last year, with an average membership of 250. The fellow who cannot afford to belong to the club may play the game on the public courses, as one or more now are maintained in 156 cities. Land and buildings used for golf are estimated to be worth $1,300,000,000, while the annual dues paid to clubs in this country is in the neighborhood of $100,000,000. To determine the amount spent for other accessories used in connection with the game, a multiplying factor of ten should be used. The foundry industry has found a market in this field, for now the heads of various clubs, special markers, and other accessories are cast of ferrous and nonferrous metals.



Remember that Approach To the Nineteenth Hole?

Find Where Castings Can Be Sold

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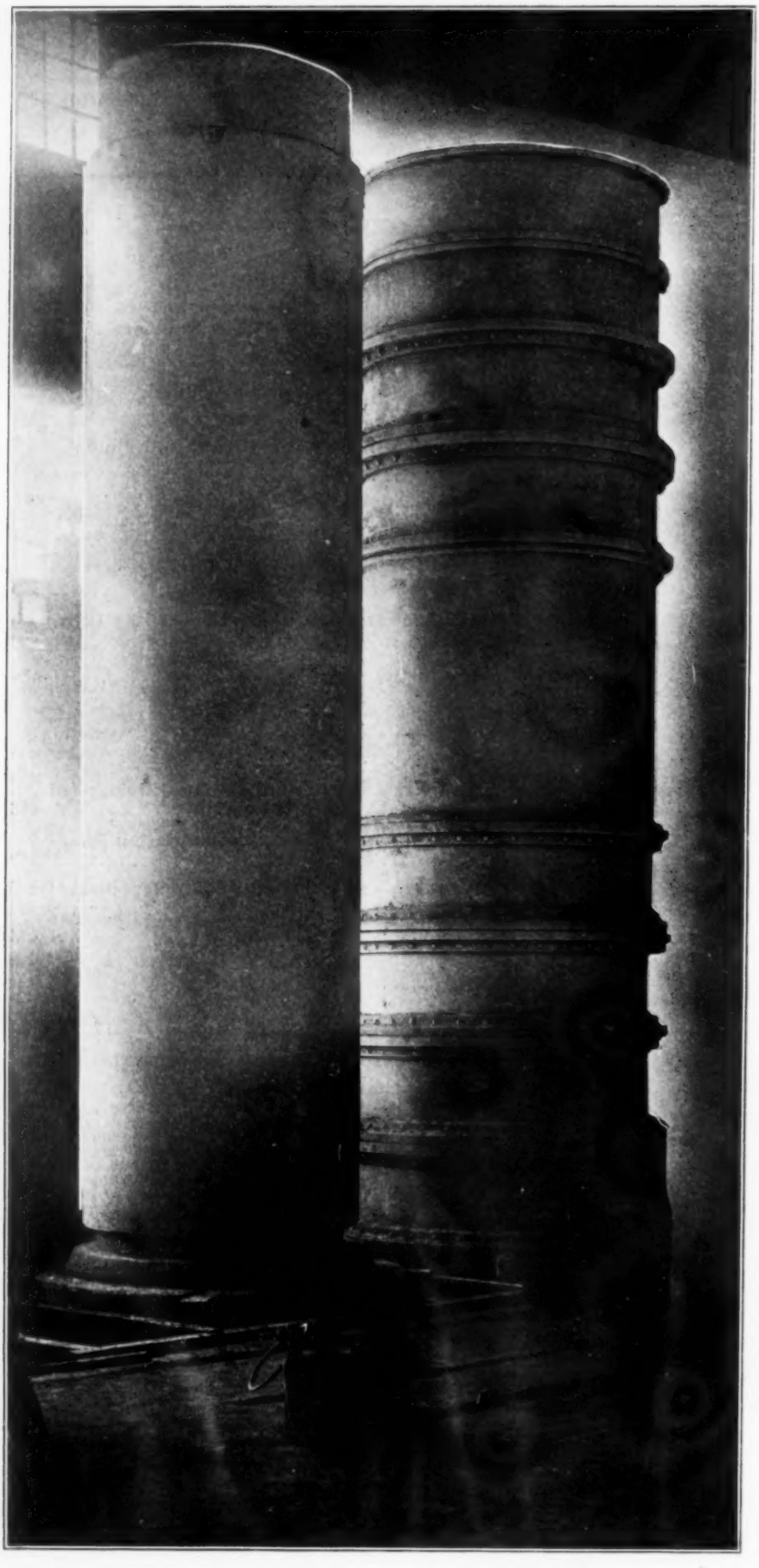
FIG. 1—Truck for the drying oven runs on a depressed track. Molds and cores for some of the dryer shells are over 20 feet high



LARGE

BASIC principles underlying the art of molding are the same whether the casting is to weigh ounces or tons and irrespective of the metal to be employed in filling the mold. A cavity is formed in some refractory material, the metal is melted in a suitable furnace and while in a fluid state it is poured into a mold where it solidifies into the required shape. Nothing apparently could be more simple and yet even the uninitiated will realize that a vast difference exists in the detail of constructing a mold for a 40-ton turbine runner and one for a 4-ounce washer.

In the latter case a group of patterns attached to a gate is provided. The operator throws a few shovels of sand into two half flasks, squeezes them both at one time, removes the pattern plate, closes the two halves of the mold and pours it along with 100 of its fellows, all in a day.

In the second case the patternmaker supplies a few coreboxes and sweeps. Several men spend days and sometimes weeks in making the cores. Other men spend additional days or weeks in assembling the cores into a unit that will serve for a mold to receive the metal. Sand is measured not by the shovel but by a grab bucket that lifts a ton. A crane with the strength of 1000 men conveys the various parts of the mold from place to place as required in the sequence of construction.

Everything is done on a large scale. Every step must be planned in advance and the finish of the job must be visualized before the first step is taken. A high degree of skill and knowledge are essential on the part of patternmakers and molders engaged in the production of large castings for paper making machinery, hydraulic turbines, electric steam generators and other machinery such as is manufactured by the Dominion Engineering Works, Ltd., Montreal, Canada. Molds for a few of these castings in various stages are shown in the accompanying illustrations. Views of the building and equipment together with several of the castings were shown in an article which appeared in the Sept. 15, 1925 issue of THE FOUNDRY.

The mold shown in Fig. 1 is for one of the large dryer shells used on a Fourdrinier paper-making machine. This machine, with the single ex-

Castings Used *in Building* Paper Mill Machines

ception that it is made in larger units, is substantially the same as the first machine erected in England in 1803 and is in use all over the world wherever paper is made. The machine on which all newspaper is made may be divided into the wet part and the drying part. The paper is formed on the wet part and given a consistency which properly entitles it thereafter to be called paper, the remainder of the process consisting in still further increasing its consistency, drying it, giving it surface, etc.

Liquefied stock is pumped from a reservoir and flows through a head box with a wide narrow aperture over an apron onto an endless horizontal wire cloth moving continuously forward. The relative rate of flow and speed of the machine determine the thickness or weight of the paper. The sidewise spread of the stock is limited by two rubber straps called *deckles*, one at each side of the wire.

Water drains off through the wire and the fibers are deposited on the surface. So much of the water is removed through various devices that when the fiber film reaches the point where the wire cloth turns on its backward journey, it is sufficiently compact to be separated from the wire and conveyed to and through the presses which are massive rolls mounted in pairs. After leaving the presses the paper readily carries itself across a short gap and enters the dryers. These are the castings made in the type of mold shown in Fig. 1.

Cylinders vary from 3 to 5 feet in diameter, from 10 to 20 feet in length and are mounted in batteries ranging in number from 20 to 30 on different machines. They are arranged in two horizontal tiers, one above the other in staggered formation. The paper passes part way around each dryer going alternately from one tier to the other. It is conveyed by endless canvas which press the paper against the surface of the dryers heated by a constant passage of steam on the inside. From the dryers the paper goes through a series of highly polished chilled iron rolls known as calender rolls and arranged in a stack. The paper goes in at the top and emerges at the bottom as a finished product where it is wound on a reel.

From the foregoing it is apparent that the dryer shell castings must possess certain qualifications that render their production in the foundry anything but a simple problem. The entire outer face is machined and must present a perfectly clean, smooth surface. The metal thickness varies from ¾ inch on the smaller shells to 1⅛ inch on the largest. The Dominion Engineering Works, Ltd., has met with gratifying success in the production of these castings according to the method illustrated in Fig. 1.

The mold shown in this illustration is for a dryer shell 60 inches outside diameter, 57¾ inside diameter and 234 inches in length. A head, the full size of the internal flange and from 12 to 14 inches in length, is provided on these castings, so that in this instance the total length of the casting including nearly 3 inches contraction allowance was almost 21 feet.

To insure perfect alignment between the inside and outside of the mold both parts were built on the same base plate and were struck from the same spindle. A tapered seat first was built on the plate. Then the steel curbing was set in place and lined to the top with a single course of brick. Contrary to the usual method of sweeping a thickness of loam on the face to a height of about 6 feet from the bottom and then waiting until that stiffened before sweeping another section above it and so on to the top, the entire face of the

Fig. 2—Cores forming the buckets on large water wheels are assembled on a heavy cast-iron plate machined to a true surface on one side. The plate is split along the center so that one half may be drawn back and then moved forward into place with the last core of the set

wall was covered simultaneously. Two small platforms were attached to the spindle, one 6 feet from the bottom and one 12 feet from the bottom. The loam was applied by four men, one at the bottom of the mold, one on each platform and one leaning over from the top on the outside.

Cut Hole In The Roof

After the roughing coat had dried, the face was *slipped up* with a thin coating of fine slurry. The spindle was removed temporarily while the crane was lifting the finished part of the mold from the base and setting it on the oven car. Four long slings suspended from a cross were employed to handle the mold. They were attached to four lugs on a lifting plate provided for the purpose under the stack of round flasks.

The spindle was replaced in the spindle seat, the outside sweep was replaced with a suitable sweep for forming the core or inside part of the mold and then a single brick wall was built to the required height. It was loamed and finished after the manner practiced on the other part of the mold. The core and mold were placed in the oven one afternoon and were taken out dried on the following morning.

To facilitate both making the mold and pouring the metal, the mold was built in a pit 16 feet deep and afterward assembled and poured in the same pit. Incidentally it may be of interest as illustrating the length of the spindle, to state that in making one exceptionally long mold it became necessary to cut a hole in the roof through which the upper end of the spindle projected before the lower end was hoisted clear of the mold.

The upper end of the core projected above the upper end of the cheek when the mold was assembled. The discrepancy in height was equalized by a ring core containing a number of small pop gates. This core rested on the outside part of the mold and also hugged the inside core closely like a collar. The metal was poured into a circular basin which fed the ring of pop gates. The mold was bound together by four slings extending from a cross on the top to four lugs on the foundation plate. A steel curbing was placed around the lower part of the mold and the space between the flask and the curbing was rammed solidly full of sand to prevent any possible run-out at the joint. The casting weighed 20,000 pounds.

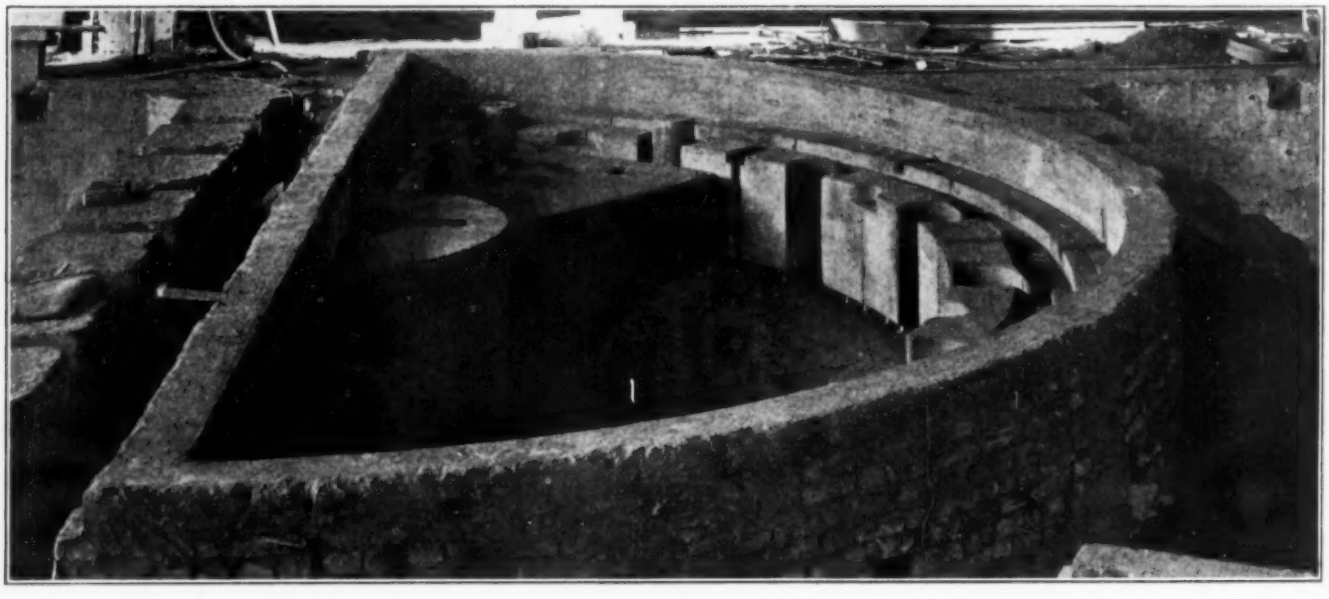


Fig. 3—Exterior part of this mold for a half head cover for a 28,000 horsepower turbine is swept in a brick and loam mold. The interior is formed entirely in dry sand cores

Method of assembling the mold for a runner weighing 80,000 pounds is shown in Fig. 2. This in itself is a job involving close attention and a high degree of skill on the part of the molder, but if possible even a greater degree of the same attributes is required on the part of the patternmaker who lays out and makes the coreboxes, also on the part of the coremaker who makes the cores.

To secure maximum efficiency from these prime movers it is essential that they run in perfect balance and perfect balance only is secured by absolutely accurate spacing of the vanes. In making these cores it is claimed that a variation of 1/64-inch is regarded with suspicion. Theoretical shape, size and position of the vanes is worked out and determined in the drafting office. The patternmaker converts the drawing into tangible shape as a corebox designed to form the inside face of one vane and the outside face of an adjoining vane. In addition, each core forms part of the band which binds the vanes together on the outside and the hub on the inside which afterward is mounted on the shaft. An auxiliary row of cores supports the overhanging part of the main cores on the outside and also forms the outside face on the band which holds the vanes in place. The end of one of these cores may be noted in the extreme lower left corner in Fig. 2.

Distortion of the corebox is prevented during the ramming period by anchoring it to a rigid foundation on the floor and to one of the building columns at the back. The box is strongly constructed from heavy lumber braced with straps where necessary and held together by steel bolts. Necessity for these precautions will be appreciated in considering that one of these cores may weigh 10 tons. The box is constructed in several sections to facilitate ramming the sand and setting the irons in the crooked sections, also so that the various sections may be removed in a manner that will not disturb the core.

Ingenious Reinforcement

Peculiar shape of the core prevents the introduction of a one-piece cast iron arbor. The necessary rigidity is secured through a great number of individual crooked cast iron bars bolted together in several series. The interior is filled with coke to form a vent passage and suitable lifting

Fig. 4—Steel curbing rammed full of sand is employed around molds that are assembled above the floor level also parts of molds that extend above the pits

hooks are located at points that will insure a level lift when the core is suspended from the crane. More than usual care and skill are required in building the core, because it has to be lifted without distortion while it is green and placed on the core oven car.

Turnbuckles attached to the crane chains are adjusted in such a manner that the core is started gently and uniformly from its seat in the box before the weight is taken by the crane. The same precaution is observed in lowering the green core on the car. The craneman allows the load to descend until the lower surface touches the plate. The overhanging part of the core then is supported by suitable cast iron stands designed for the purpose.

Accuracy Is the Keynote

From the foregoing it may be noted that the core constantly is maintained in the same position it ultimately will occupy in the mold, with the upper and lower bearing surface held perfectly horizontal. This arrangment minimizes the amount of adjustment required in attaching the chains when lifting the core from place to place. The corebox is level, the plate on the core oven car is level and the plate on which the mold finally is assembled is level.

Methods and equipment for molding turbine runners approach in accuracy those in use in the machine shop more nearly than those used on any other class of castings in the foundry. The entire mold is assembled on a heavy cast iron plate split through the center. One half is attached rigidly to a foundation while the other half is mounted on suitable slides on which it may be moved back and forth. Rings of various diameters are scribed on the face of the plate to serve as guides in setting the cores.

In practice all the vane cores with the exception of two or three are assembled in their proper position while both halves of the foundation plate are together. The half plate on which the cores are missing then is moved back some distance where the remaining cores are lowered into place. The half plate then is moved forward again until the joint touches the joint of the permanent half. Jack screws braced against the concrete walls of the pit are employed to move the half plate with its load of cores.

A cast-iron plate provided with dabbers that gradually increase in length toward the center is bricked and covered with loam to serve as a cover for the mold.

Inadequate terminal facilities and difficulty of transportation furnish a reason occasionally for making one of the large runners in four sections. The sections are assembled after they are cast and the runner is machined as a unit. Then they are taken apart and shipped suitably marked to their destination where they are reassembled.

A mold for one of these quarter sections weighing about 32,000 pounds is shown in Fig. 6. An entire block pattern is supplied for making the mold in which the cores are assembled later. The pattern is constructed in several sections for convenience in handling. Four drawbacks are built up with the mold to provide room for setting the cores. Each of the bucket cores weighs 10 tons and involves the labor of two coremakers for 2 days. Building the mold takes up 150 hours and setting the cores accounts for 40 additional hours. The entire mold is 14 feet high and pro-

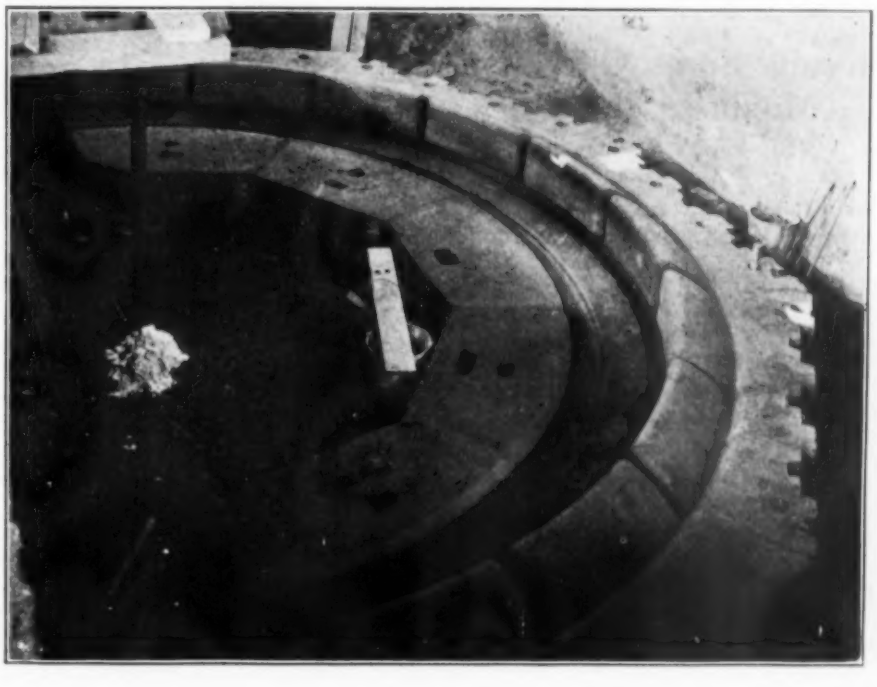


Fig. 5—Molds for half speed rings are formed entirely in cores assembled on a level sand bed

Fig. 6—Part of the pit equipment in which many of the large molds are assembled and cast. The mold partly completed and the block pattern at the left are for a quarter section of a 120,000-pound runner

jects 6 feet above the walls of the concrete lined pit in which it is erected.

The mold shown in Fig. 3 is for a half head cover for a 28,000 horsepower turbine. The casting weighs about 60,000 pounds. The bottom face of the mold is swept in loam on a suitable foundation in the bottom of one of the casting pits. The outside wall then is erected and finished with openings at suitable points to serve as vent holes for the cores. The inside of the mold is made entirely of dry sand cores resting partly on prints and partly on stud chaplets. The mold is dried in place with a number of coke salamanders. With a slight amount of refinishing the bottom of the mold will serve for several castings. The half mold for a speed ring shown in Fig. 5 is made entirely in cores assembled on a level bed swept on the bottom of one of the pits. A templet swinging on the spindle is employed to locate the cores in their proper position.

Recalls Some Old Loam Molding Practice

By Robert E. Masters

Perusal of the well written and beautifully illustrated series of articles on loam molding methods by Ben Shaw and James Edgar in recent issues of THE FOUNDRY reminded me that loam work of a high order constantly was in evidence in the New York shop where I served an apprenticeship in the sixties. Later during my 45 years' active connection with the foundry industry I have had more or less experience with loam molding methods. I retired from the foundry 15 years ago and five years previously severed my connection with the last foundry in which loam molding was practiced. In reading the present series of articles I was interested to note that equipment and methods in this most ancient branch of the molder's art have not changed to any extent.

In the Feb. 1, 1924, issue of THE FOUNDRY I referred to an ammonia cylinder, 3 feet inside diameter, 12 feet in length with the closed end cast down and with the core suspended from the cope. This casting was instanced not because it was made in a loam mold, but because it was poured through a ring of small pop gates on the top. Considerable discussion and description of this system of gating was published in THE FOUNDRY in 1923. The ammonia cylinder was poured in 1880.

In that old New York shop back in the sixties we had a large loam pit with all the necessary spindles, seats and strike arms. Jobs of average height were swept from a heavy spindle that required no top brace. We had a lighter shaft for tall slender molds that was held true at the top by a suitable brace. Part of the apprentice's duty was to rub dried horse manure into the loam mixture. In later years I have had to speak real earnestly to a few Mary Jane apprentice boys who felt that they should quit rather than engage in such revolting practice. I have seen no reference to this ingredient in recent loam literature and I have wondered if the use has been discontinued.

We were not so hopelessly old fashioned in the sixties and seventies. For example, we had a machine that twisted hay rope as firm and smooth as any I have seen since. We also had a power operated riddle, 2 x 4 feet, 6 inches deep which ran back and forth on a track the length of itself and received a bump at each end. Think of that now, in ye olden tyme, and it was a good sand sifter too.

Cast iron syrup kettles up to 150 gallons capacity were made to order and also carried in stock. At one time we filled an order for six kettles 8 feet inside diameter, 7 feet deep with a 6-inch flange around the top. The molds were made in dry sand and the castings were delivered on board ship for export without a flicker on one of them.

Book Review

How to Buy and Use Fuel Oil, by Stephen O. Andros, 127 pages, board, 7½ x 5 inches, published by Haupt Publishing House, Chicago, and supplied by THE FOUNDRY, Cleveland, for $2.00; London for 10s.

Popularizing a more or less technical subject is a feat generally hard to accomplish, but the author of this book has done well. In many instances Mr. Andros has reverted to the snappy language of the day to illustrate a point, and sometimes includes facetious remarks that have nothing to do with the subject, but are entertaining. To many technical readers, a book written in this style is an abomination, and the author has committed a horrible crime to be punished with dire consequences. Even though the reviewer may lose caste among his technical brethren, he must admit that he enjoyed reading the book. Mr. Andros has not omitted any pertinent points in his descriptions of buying and using fuel oil. In fact some points are made more pertinent by succinct language. The appendix is devoted to rules for unloading cars, measuring the gallonage of tank cars, and legal points involved in purchasing and selling.

Reclaims Foundry Sand

New Sand Cost Cut from $1 Per Ton of Castings to 20 Cents in Three Years—During the Same Period the Loss Is Reduced from 8.4 Per Cent to 4.0 Per Cent

By A. A. Grubb

MANY foundries for years have used portions of runway sand in core and sand mixtures and have returned quantities of such sand to molding floors to be reused. Several years ago, Walter M. Saunders operated molding floors in a Providence, R. I., foundry on rebonded refuse sand alone and obtained good results. However, in general, the reclamation of foundry sands has not been carried on successfully or economically by foundries until within the past few years. This was not due to a lack of ability to rebond and restore the sand, but rather to lack of adequate means of measuring the important physical characteristics of the heaps and maintaining the proper values. The work of the American Foundrymen's association's subcommittee on tests, under the leadership, first of H. B. Hanley and later of Dr. H. Ries, in a large measure has filled this need and we now have effective methods of test designed to measure the working properties of sands. As a result, we now are able to reclaim much of the burned sand and floor sweepings, which formerly went to the dump, and introduce them into our molding heaps without dangerously altering their characteristics.

The successful reclamation of foundry sands depends in a large measure on control of the characteristics of the sand heaps. It is essential that a certain amount of the theory and practice of sand control be understood before attempting to reclaim sand on any large scale. Therefore, first the writer shall discuss briefly the common characteristics of sands and the methods that have been found effective and practical for measuring and controlling them, and then show that much of the refuse sand now passing to the dump may be reclaimed economically.

There are certain physical and chemical characteristics that distinguish good molding sand. The texture or grain size must be such as to produce the proper surface on the castings and yet permit the escape of mold gases through the sand. There must be sufficient bonding material or clay to bind the grains together into a more or less rigid mass capable of resisting the abrasive action and pressure of the molten metal. The composition of the grain must be such that it can stand the temperature of the molten metal without excessive fusion and the composition of the clay must be such that heat will not cause rapid deterioration of the bond.

These properties or characteristics always have been recognized by foundrymen, but until recently little or no effort was made to measure and control them accurately. During the past few years careful study of molding sand characteristics has been made in a number of foundries and practical tests have been devised for measuring the characteristics.

An analysis of molding sand shows that it is composed of grain and clay. As a rule, the grain is largely silica with small quantities of alumina, iron oxide and other impurities. The clay contains the same chemical elements but arranged differently and in different proportions. The percentage of silica is lower while there are larger proportions of alumina, iron oxide, and aluminum and iron silicates. Small percentages of organic matter, calcium, magnesium, sodium and potassium salts also are found and may be classed as impurities. In general, they tend to lower the fusion point and perhaps decrease the durability of the sand. The silica and alumina are the most refractory constituents of sand.

Aside from the chemical composition, the grain distribution and the physical condition of the material is highly important. The American Foundrymen's association's standard fineness test prescribes a method for separating the clay from the grain and then screening the grain. The clay so separated is that material which is divided so finely or so light that, when suspended in water, it fails to settle out in a certain period of time. Material in such condition has radically different properties from material of the same chemical composition but in larger particles. It clings together more readily, especially when mixed with a small proportion of water. This property becomes more evident, the smaller the particles. In coarse sand it is scarcely evident at all; in fine sand, 200 to 300 mesh, it is noticeable and in clay where the particles are from one thousandth down to perhaps a millionth of an inch in diameter, this sticky characteristic predominates. The bonding power of clays, then, may vary

Cost Figures Show Saving

SAND reclamation is receiving considerable attention from progressive foundrymen since the cost of placing new molding sand on the floor is mounting each year, due to increasing freight rates. Disposal of discarded sand also is becoming a problem in the larger cities. The final analysis of any change in method or of any reclamation system is found in the cost figures. The change must not increase production costs and preferably should show a saving. The interesting results of sand reclamation at the Ohio Brass Co., Mansfield, O., are portrayed by the following figures: In 1923, $2420 was spent for new molding sand at the cost of $1 per ton of sand per ton of castings. Reclaimed sand in 1924 amounted to 177½ tons or 47½ per cent of all sand used. New sand cost $832.40 or 40 cents per ton of sand per ton of castings. 1925 showed a further increase and 62.3 per cent of the sand used was reclaimed. This cost is 20 cents per ton of sand per ton of castings. The author of this paper A. A. Grubb is director of laboratories, Ohio Brass Co., Mansfield, O. The paper was presented at a meeting of the Quad City Foundrymen's association, Moline, Ill.

widely, not because of a difference in chemical composition but through a difference in fineness of its particles. Some clays are composed largely of particles but little smaller than a thousandth of an inch in diameter while others are composed largely of particles only a tenth or hundredth as large; these latter are far more sticky and are much better bonding agents than the larger particles.

Colloids Are Finely Divided

Because of its peculiar properties, this finely divided material which is capable of remaining in suspension in water almost indefinitely, is called colloidal matter. It has great absorptive properties, especially of dye stuffs. Advantage of this fact is taken in the American Foundrymen's association's dye adsorption test which serves as a measure of the quantity of colloidal material in a sand.

We now are in position to understand fairly well the mechanics of that important working property of molding sand called bond or bond strength. Bond results in part from the surface tension of water in the voids between the sand grains and in part from the sticky clay or colloidal material in the sand. The force of surface tension is sufficiently great in fine sands, those of an average fineness of say 200 mesh, or higher, to permit its use in forming a mold, even though it contains no sticky clay. Upon drying such a mold, the bond almost entirely disappears and the sand easily washes with the molten metal or even may fall in before the mold is poured. Such sand is unsatisfactory for green mold casting—because the first molten metal dries out the water, destroys the bond, and allows the sand to wash. It is the sticky clay or colloid material that gives the sand that bond which is evident not only while the sand is green but persists even after the moisture has been removed.

This colloidal clay has another characteristic which is of great importance in the life of molding sand. Heat tends to burn the tiny particles together into larger aggregates or bodies which are no longer of colloidal dimensions and no longer have colloidal properties. Low temperatures, 200 degrees to 250 degrees Fahr. effect them but little if at all; at 600 degrees Fahr. there is marked deterioration and at 2100 degrees Fahr. practically all colloids in sand are destroyed. It is this deterioration of the colloids that accounts for burning out of molding sand. Consequently, we find burned molding sand is low in colloidal materials and the process of reclamation largely is one of restoring them in proper quantity and kind.

The bond strength of molding sand is determined not only by its clay content and its grain size, but also by the distribution of that clay. If the clay is merely mixed through the sand, low bond results. If it is coated uniformly on the grains, much higher bond is obtained. The writer has succeeded in more than doubling the strength of a given mixture of high and low bond sands by mulling for a period of time. This fact should be kept in mind when attempting to reclaim spent sand by additions of clay.

There are several methods by which bond strength may be measured, each of which has its advantages and disadvantages. The tentatively adopted American Foundrymen's association's method has been found satisfactory for control work in a number of foundries but the writer considers it too slow and hardly sensitive enough for the purpose. H. W. Dietert, United States Radiator Co., Detroit, rams up a cylindrical core of sand in a tube, removes the core and measures the compressive force required to crush it. The writer believes that a tensile test is the only true and direct measure of bond strength and has devised a method for measuring the tensile strength of a standard specimen of sand in terms of ounces per square inch or grams per square centimeter. This method of measuring bond strength is more sensitive than the American Foundrymen's association's bar test, the latter giving results that roughly are proportional to the square root of the tensile strength.

Permeability Is Important

Permeability is another important property of molding sand. By this term we mean its openness, or the degree of freedom with which it will allow gases to escape. Permeability is determined largely by the grain size of the sand, and probably to a less degree by the uniformity of the grain, the clay content and the distribution of the clay. Inasmuch as the introduction of reclaimed sand into a heap is apt to change the average grain size of the sand and also perhaps the other characteristics which determine permeability, it is highly important that this property should be controlled carefully if reclamation work is to be carried on successfully. The American Foundrymen's association subcommittee on tests has developed a simple but effective outfit for measuring permeability. The outfit and method of test is fully described in the booklet, "Tentatively Adopted Methods of Test," published by the American Foundrymen's association.

Clay content is an important factor in determining working properties of molding sand. Clay absorbs great quantities of water and when a heap contains excess clay over that actually necessary to produce the bond strength required for the work, that clay not only tightens up the sand, making it less permeable, but also requires excess water to bond it; when the molten metal comes in contact with the sand, the water is of course changed to gas which must escape if a perfect casting is to be produced. Thus excess clay frequently is responsible for blown castings. Furthermore, if the clay is not distributed uniformly through the sand, if it exists in the form of clay lumps or pellets, serious results occur. These pellets absorb large quantities of water and when the hot metal strikes them they explode, forming rough spots or scabs on the castings. Such a condition can be prevented by using less clay and distributing it better through the sand.

Bond Must Coat Sand Grains

The maintenance of proper sand characteristics is not merely a matter of sand additions. It is a difficult matter to put bonding material into refuse sand or into a sand heap and distribute it over the surface of the grain. The general practice, so far as molding heaps is concerned, is to add sufficient quantity of well bonded sand to maintain bond even though the clay is not well distributed, and discard to the dump enough floor sweepings, burned sand, etc., to maintain proper volume of the heap. There is really an excess of clay in the heap over that which would be required to give the necessary bond if it were distributed properly.

The sand that is discarded usually is not bad material. Part of the original clay, sometimes as much as half or even more of it, still is present and in good condition. However, some of it has been dehydrated and burned into brick-like material, which now appears either as dark irregular shaped fragments or as bonding material cementing some of the smaller grains together into aggregates or composite grains. If we wash the clay out of burned molding sand we find two types of grains, the clean silica and the composite grains, both of which easily can be recognized under a lower power microscope. To reclaim such burned sand it is nec-

STANDARD PATTERN COLORS

ADOPTED BY THE JOINT COMMITTEE ON PATTERN EQUIPMENT STANDARDIZATION.

(Concluded on Data Sheet No. 626)

STANDARD PATTERN COLORS

(Concluded from Data Sheet No. 625)

The Joint Committee on Pattern Equipment Standardization consists of official representatives from the following national organizations: American Foundrymen's association, sponsor, American Malleable Castings association, American Institute of Mining and Metallurgical Engineers, American Society for Testing Materials, Electric Steel Founders' Research group, National Association of Pattern Manufacturers, National Association of Purchasing Agents, Foundry Equipment Manufacturers' association, and the Steel Founders' Society of America. This committee recommended and the various organizations have approved the following standard practice for pattern painting:

1—Surfaces to be left unfinished are to be painted Black.

2—Surfaces to be machined are to be painted Red.

3—Seats of and for Loose Pieces are to be Red Stripes on a Yellow Back ground.

4—Core Prints and Seats for Loose Core Prints are to be painted Yellow.

5—Stop-offs are to be indicated by Diagonal Black Stripes on a Yellow Base.

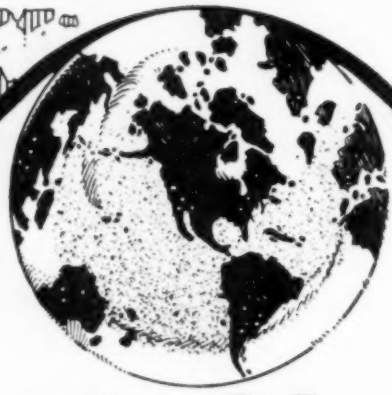
The color chart with key numbers as indicated is shown on Data Sheet No. 625.

From a chart printed and issued by the American Foundrymen's association, 140 S. Dearborn St., Chicago.

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

THE FOUNDRY DATA SHEET, JUNE 15, 1926

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication



Around the World with The Foundry

Little Journeys to the homes of our readers

Sweden

ENDOWED with a charming personality and a singing voice of a purity and range never surpassed on the operatic stage, a gracious lady appeared out of Sweden in the middle of the 19th century and gave her native land a greater measure of prestige than that conferred by any other of a long line of illustrious sons and daughters When Jenny Lind's glorious voice soared away on the wings of melody in her favorite encore "Home Sweet Home", tingling heart strings and moisture suffused eyes bore eloquent testimony to the rare and exquisite gift of a singer whose wholesome, unaffected simplicity only served to accentuate the beauty and purity of the golden flood cascading from her lips.

In that far northern land a peculiar formation of iron ore singularly free from impurities and melted with charcoal, served to build up a reputation for Swedish iron which endures to the present day. Modern blast furnaces and rolling mills have taken the place of the primitive stacks and bloomeries operated by water wheels, but the quality of the iron remains constant and still is specified by exacting customers where great strength, purity and homogeneity are essential factors. The foundries have kept pace with the development in all branches of industry and in 29 of the principal casting plants in the country THE FOUNDRY is read twice a month by members of the executive staffs.

"Wherever metals are cast you'll find THE FOUNDRY"

essary to add new clay and distribute it over the surfaces of these grains.

The chemical composition of the clay can vary just as widely as does the composition of the clay on the natural molding sands. Red clays that are high in iron oxide seem to be just as satisfactory for some types of work as are the more refractory fire clays, although the latter would be preferable for rebonding steel sands.

Several types of clay or bonding material for use in reclaiming burned sand are available. Some materials especially prepared for the purpose contain from 60 to 80 per cent of clay, the rest being ordinary silica grain. The writer has had good success using high bonded molding sands for the purpose, molding sands containing from 30 to 40 per cent of clay are obtainable readily. They must of course be used in larger proportion than those materials richer in clay. The screen analysis and dye adsorption tests afford information from which to judge bonding materials. The grain should be of such size as to help offset the tendency of the sand heaps to become too tight or too open, whichever it may be. The higher the dye adsorption value, the stickier is the clay and the less of it will be necessary in the sand heaps. Some advantage in mixing may be obtained by air drying the bonding material and then grinding or crushing it in a dry pan or muller.

Control Clay Additions

The quantity of clay added to rebond the burned or refuse sand should be controlled carefully. Excess clay over that actually necessary to maintain the bond only increases chances for loss.

It is highly important that the physical characteristics of the molding heaps be watched carefully when reclaimed sand is used. This presupposes knowledge regarding the permeability and bond values best suited to the type of work being cast, and this knowledge may be gained only by making regular and frequent tests on the heaps and by correlating this data with the detailed loss records of the heaps. When once that permeability value has been determined which gives a minimum of blown and misrun castings and that bond value has been found that produces the least dirty and sand cut castings, then these values should be maintained.

The writer does not mean to infer that there are not conditions other than low permeability of the sand that causes blown and misrun castings or conditions other than low bond that cause dirt and sand cuts. Such losses may be, and often are, caused by improper moisture content, too hot or too cold metal, by improper ramming or other causes, but so far as the sand is concerned, there is for every job an optimum permeability and an optimum bond value, and chances for loss are decreased by determining these experimentally and then maintaining them.

When burned sand is reclaimed and returned again and again to the heap, a change in grain size may result and a corresponding change in permeability and bond occurs. Under certain conditions, when excess clay is used particularly, there is a tendency to tighten up the sand without a corresponding increase in bond. Under other conditions, the average grain size may become larger, the permeability will increase and the bond will drop. If castings are cored and the core sand is coarser than molding sand, the burned core sand which mixes with the molding sand tends to coarsen it. Any tendency for the heaps to tighten up or become more open should be offset by the addition of course or fine sand, as the case may be.

Now just a few words about how we operate our sand control and reclamation at the Ohic Brass Co. The floors and gangways of the brass foundry are swept each evening and the sweepings are put over a 12 mesh screen. Metallics are recovered from the oversize material by a ball mill and concentrating table while the undersize is rebonded in a muller type sand mixer manufactured by the National Engineering Co., Chicago, and returned to the molding floors. Each molding heap, of which there are 40 in the brass foundry, is tested for bond and permeability periodically, some of them every day, others only once or twice a week, as experience indicates the need. These tests are made in the foundry by the man who makes the sand additions. Each week three floors are sampled and tested in the laboratory for clay content and grain size. The average grain size is calculated for convenience in comparing results. The sand additions are made up according to the requirements of each heap. They are composed of 70 to 90 per cent refuse sand, 3 to 15 per cent high bond sand, and the remainder new molding sand. The refused sand is considerably coarser than our heap sand, due partly to burned core sand, so we find it necessary to use some new fine sand in order to maintain proper grain size. The bonding sand contains about 30 per cent sticky clay and is used only in sufficient quantity to maintain a clay content of 6 to 8 per cent in the heaps. Batches of sand are made up in the bucket of the loader which delivers them to the muller. Water is added and each batch is mulled at least five minutes, longer if possible. The rebonded sand is then delivered to the heaps and cut in by hand. In case the molder keeps his floor clean and loses little sand, the bond sometimes drops while little if any addition of sand is required. In such a case we actually take sand from his floor, rebond it and return it to the heap.

System Proves Successful

The system outlined above has proved successful; so successful in fact, that we are extending it to 60 molding floors in our malleable iron foundry. Not only has there been a marked reduction in sand costs but there has been a great reduction in molding losses, which may be credited in part at least to the control exercised over the molding sand characteristics. Following are sand cost and foundry loss figures for our brass foundry since 1922.

Year	Sand Cost per ton of castings	Foundry loss
1922	$1.00	8.5%
1923	1.00	8.4%
1924	.40	4.2%
1925	.20	4.0%

The sand cost figures cover material only. To the totals for 1924 and 1925 should be added the labor involved and overhead on a muller and testing equipment. One man handles this work for 40 molding floors. Therefore, the sand reclaimed more than pays for the expense involved and also gives us the benefits of control and the resulting reduction in losses as clear gain.

How Fillets Came To Be

Prior to 1810, the use of fillets to strengthen the corners of iron castings was unheard of. Although at that time foundry practice in general was highly developed, so little was known of the internal structure of castings that corners were made as clean and sharp as possible. The first man to call attention to the fallacy of this practice, and to advocate the use of fillets, was Henry Maudslay, who invented the modern screw-cutting engine lathe at London about 1800. Maudslay soon found he needed stronger castings for his lathe beds and forthwith inaugurated the use of fillets, although the foundryman who made the castings is understood to have protested.

Fig. 1—One of a pair of short conveyors on which the molds are pushed around by hand

Costs Show Lower Trend *on Installing* New Foundry Equipment

By Pat Dwyer

ONLY brief and passing reference to the mechanical equipment in Central Foundry, Saginaw, Mich., was made in the June 1 issue of THE FOUNDRY. Since this equipment, directly and indirectly has increased the production from 200 to 600 tons per month, manifestly it deserves further comment. Mold conveyors and sand handling equipment presented a medium for securing a vastly increased output from the original floor space and in that manner contributed directly to the solution of the problem. Installation of the equipment involved changes in personnel and methods, an opportunity to increase the working force without overlapping of effort and in that manner contributed indirectly to the desired result.

Foundry executives, particularly those connected with foundries that are parts of manufacturing plants, are confronted at times with a demand that may take one of two forms. In the first they are ordered arbitrarily to increase the output of castings to a certain definite point to coincide with an increased manufacturing schedule which in turn, of course, is based on a change in the sales policy of the corporation. Expense is no object—at the time. The general order goes out to attain a certain production by a given time. In the second form, the order calls for an increase in production, but sufficient time is allowed and the changes are introduced so gradually that the added expense is absorbed in a manner that is not noticeable.

In either case recognition is taken of the fact that the cost of production during the transition period is increased over that which prevailed under former conditions and over those which are anticipated under the improved conditions incident to the change. In the Central Foundry it is claimed that the production cost curve has shown a steady downward trend even during the period while making radical changes in equipment and methods necessary to meet a steadily rising demand for a greater and greater supply of castings. At present the cost per pound of the castings is the lowest in the history of the plant and a still lower figure confidently is anticipated when a few remaining changes have been made and a few remaining pieces of equipment have been installed.

This point is touched upon by Arnold Lenz in the annual exchange paper of the American Foundrymen's association to be presented before the convention of the Institute of British Foundrymen, June 15-19. Mr. Lenz is assistant division manager of the Saginaw Products Co., and has been actively connected with the Central Foundry since the plant was built in 1919, first as assistant superintendent and later as superintendent. His paper is designed to show primarily that mass production, through simplifica-

tion, automatically raises the standard of quality and appearance of motor castings.

From the illustration Fig. 2 it may be noted that the foundry is divided longitudinally by three rows of columns into four main divisions. A hot metal crane runway extends from in front of the battery of four cupolas to within two column's distance, 40 feet, of the wall which separates the preliminary cleaning room from the foundry proper. One main branch of this runway is over the gangway that parallels the outside of the first and third rows of columns. The second branch is located above the gangway that parallels the same rows of columns on the inside. Suitable switches at convenient points permit passage of the crane-carrying ladles from one main branch of the monorail to the other.

Ladle Handling Devices

Eight of these special ladle cranes, supplied by the General Electric Co., Schenectady, N. Y., are kept in constant service all day conveying metal from the cupolas to the pouring stations near the five mold conveyors. These cranes and ladles are not employed to pour the molds. The metal is transferred at the pouring stations to smaller ladles suspended from short rail loops. This feature is shown clearly in Fig. 3, with the cupola ladle to the left in the act of filling one of the ladles used for pouring the molds. A second ladle is shown in position a little to the right engaged in pouring a row of molds mounted on the conveyor. One man tips the ladle with a wheel while a second attendant manipulates the electric hoist by which the ladle is suspended from the short crane runway loop.

Although the pouring rail parallels the row of molds for a distance of 40 feet, thus affording a flexible link in the chain of operation, still it is apparent that the iron must appear at the station with clocklike regularity and at frequent intervals. To meet the present schedule each ladle has to make a round trip to the cupolas in approximately 6 minutes and keep it up all day. Every feature in the cycle of operations required to produce castings has been speeded up to the limit, and the performance of the men who drive the ladle cranes is spectacular to a degree. To the casual spectator collisions seem imminent every instant from the numerous ladles rushing to and fro at top speed. Visions of a ladle upset and a shower of molten metal flying in all directions inevitably come to mind, but after watching the marvelous performance for an hour or more the spectator has no more fear of an accident than the hundreds of employes who attend to their own work and apparently ignore the presence of the ladles altogether. Confirmation of their faith is found in the fact that no accident due to metal in transit has happened to any employe since the foundry was opened.

Layout of five, power driven mold conveyors with sand handling equipment and other auxiliary features supplied by the C. O. Bartlett & Snow Co., Cleveland, is shown in the illustration Fig. 2. Since the illustration was made, two gravity conveyors have been erected in the open space shown to the right of the center. Detail of their construction, method of operation and style of molding machine used in connection with them are shown in Fig. 7. The space to the lower left in Fig. 2 is utilized for the production of pistons made on a battery of small, rollover machines. The green sand cores form an integral part of the drag molds. The machines are arranged against a 4-foot partition separated from the side wall of the building by a 5-foot gangway extending from end to end of the building.

Uniformity in Machines

In this connection it may be interesting to note that until recently when piston equipment was taken over from another foundry, only two makes of molding machines were used in the foundry. The predominating group made by the Osborn Mfg. Co., Cleveland, and the other group made by the W. H. Nicholls Co., Brooklyn. The piston equipment is by the Arcade Mfg. Co., Freeport, Ill. The explanation presented for this choice is that it is easier to train men on one class of machines, also that the maintenance gang experience less trouble in keeping machines in good running order where the types of machines are uniform. The number of repair parts kept in stock is held to a minimum. Another reason is that a great deal of duplicate pattern and flask equipment is required on account of the heavy tonnage on a comparatively small number of different castings. For example, seven duplicate sets of machines, patterns and flasks

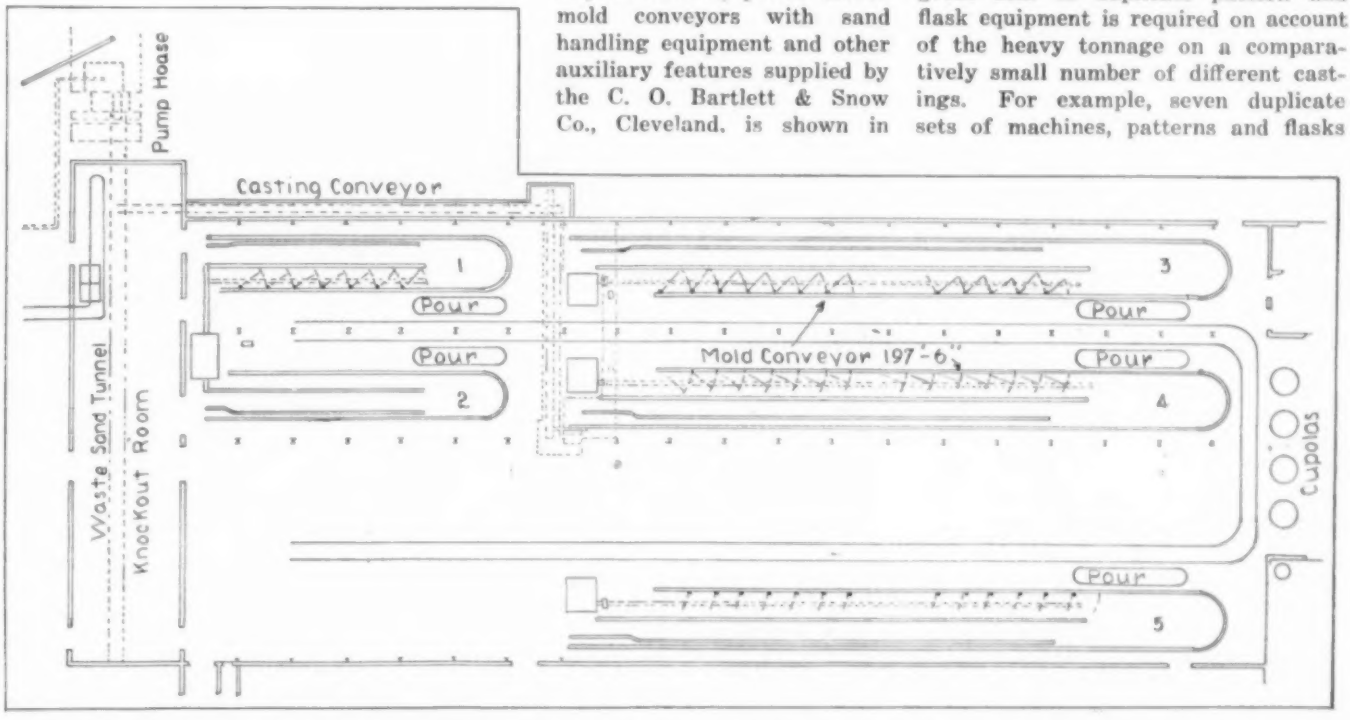


FIG. 2—GENERAL LAYOUT OF THE FOUNDRY FLOOR SHOWING THE POSITIONS OF THE VARIOUS MOLD CONVEYORS WITH AUXILIARY SAND HANDLING AND POURING EQUIPMENT. THE CUPOLAS ARE LOCATED AT ONE END OF THE BUILDING AND THE KNOCKOUT ROOM IS AT THE OPPOSITE END

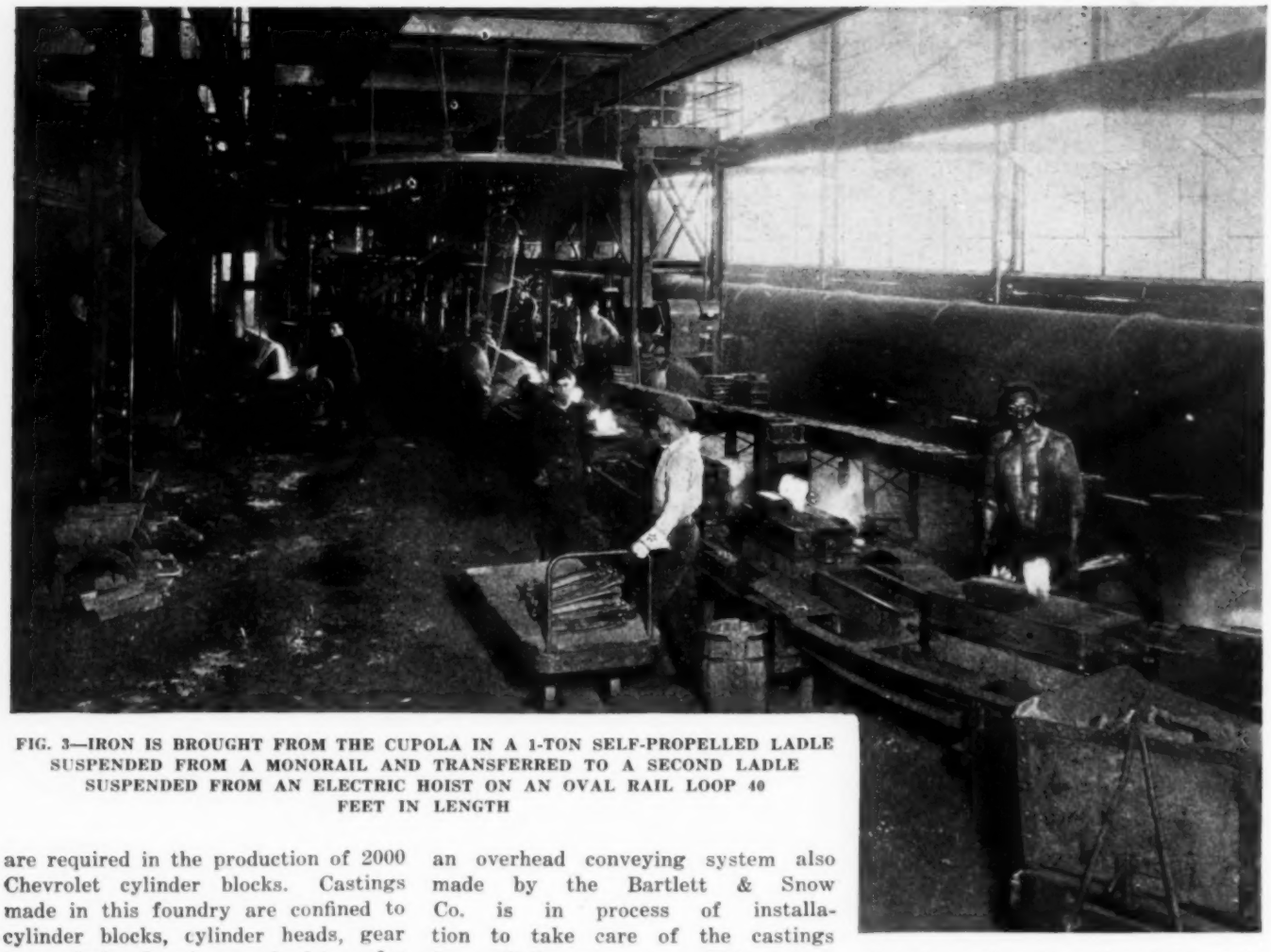


FIG. 3—IRON IS BROUGHT FROM THE CUPOLA IN A 1-TON SELF-PROPELLED LADLE SUSPENDED FROM A MONORAIL AND TRANSFERRED TO A SECOND LADLE SUSPENDED FROM AN ELECTRIC HOIST ON AN OVAL RAIL LOOP 40 FEET IN LENGTH

are required in the production of 2000 Chevrolet cylinder blocks. Castings made in this foundry are confined to cylinder blocks, cylinder heads, gear transmission housings and pistons for several lines of automobiles manufactured by the General Motors Corp.

Sand Handling Equipment

For convenience in reference, the molding units have been numbered from 1 to 5 in the illustration. The numbering is arranged in the usual manner to be read down and from left to right. The general features are the same in all five and they present but few points of difference in detail. Conveyors No. 1 and No. 2 draw their sand supply from a single bin. Each of the others is provided with an individual storage bin from which the prepared sand is distributed to the various small hoppers over the battery of molding machines. Castings made on conveyor No. 3 are dropped upon a steel apron conveyor running in a transverse tunnel under the floor and through an opening in the north wall. Outside the wall, but still in the tunnel, the castings fall on a second conveyor which delivers them into the preliminary cleaning room at the west end of the foundry building.

At present the castings made on No. 4 and No. 5 conveyor are trucked to the cleaning room, but an overhead conveying system also made by the Bartlett & Snow Co. is in process of installation to take care of the castings from all five conveyors. This system in which the castings are suspended from hooks, is designed to be erected outside the building in the form of several long loops. An estimated time of one hour is allowed for the passage of each casting from the shakeout to the cleaning room. In the passage around the curves during this hour the castings will cool to a temperature at which they may be handled without discomfort. In a general way the

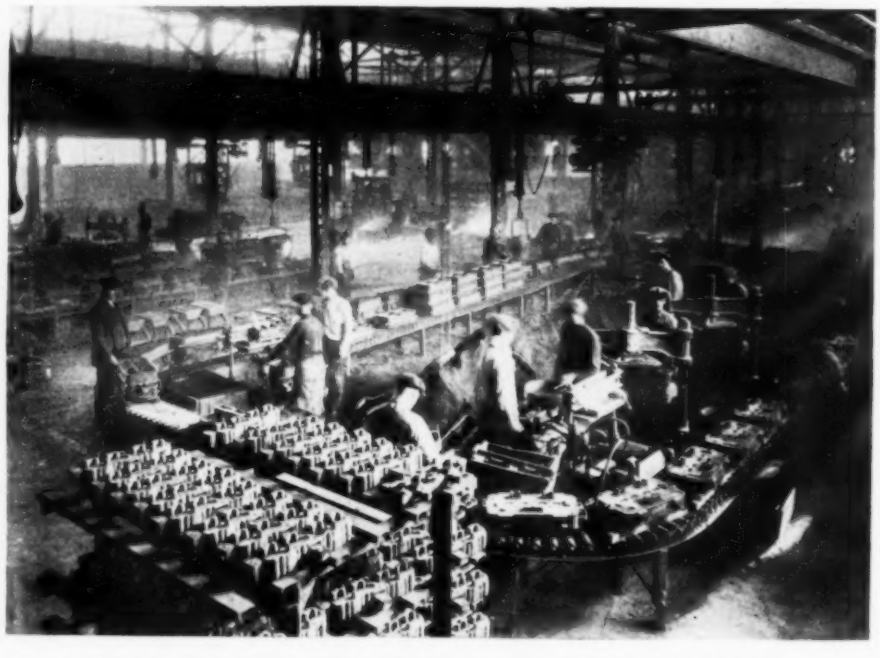


FIG. 4—ONE OF THE SHORT HAND OPERATED CONVEYORS ON WHICH CYLINDER HEAD CASTINGS ARE MADE

idea is based on the principle lying back of the worm in a still.

Each of the conveyor units includes two flight conveyors joined at one end by a gravity conveyor set to a half circle; one straight length of gravity conveyor for returning the empty flasks from the shakeout to the molding station; one reciprocating conveyor under the floor for carrying the spilled sand back to the reconditioning point and one flight conveyor overhead for distributing the prepared sand to the various molding machine hoppers arranged in a straight line close to the conveyor on which the molds are assembled. No. 1 conveyor is 100 feet in length while No. 2 is only 90 feet. Each of the three long conveyors Nos. 3, 4 and 5 is almost 200 feet in length. To be exact it is 197 feet 6 inches on the mold assembly leg and 229 feet 6 inches on the leg where the molds are cooled before they are shaken out.

Extensive Exhaust

Several features in the progress of a mold along the conveyor are shown in Fig. 5. In this particular instance the conveyor shown is No. 3, and the procedure illustrated is typical of the others. After the molds are made and poured they pass from the power driven conveyor to the curved section leading to the second, power-driven conveyor traveling in the opposite direction. This section of the conveyor passes under a continuous hood from which the steam and smoke are drawn by a powerful exhaust fan and discharged outside the building.

Molds are placed on the conveyor and assembled in transit in the manner that has become fairly familiar to the foundry industry in recent years. The drag machines are grouped near the end which marks the beginning of the conveyor unit. A small jib crane with an air hoist swings a drag from each machine to the flight conveyor. The various cores are placed in position and tested for accuracy by a number of men stationed alongside the conveyor in the space between the drag and cope molding machines. Copes from the battery of cope machines are placed on the cored drags as they pass by. One attendant adjusts the clamps which are provided with cams at the upper ends. A slight pull with a small steel bar shifts the edge of the cam so that it embraces the flask tightly.

Another attendant places a green sand runner basin over each sprue. These runner basins are jolted in pairs on a small plain jolt machine located close to the last cope machine in line. After they have served their purpose

FIG. 5—THE LONG CONVEYOR CARRIES THE MOLDS PAST THE SAND HOPPERS AND THE ASSEMBLING POINTS WHERE THE CORES ARE PLACED AND GAGED FOR ACCURACY

they are removed before the molds round the turn leading to the hooded second leg of the conveyor. The sand is knocked out and the light frame is returned to the small jolt machine to be refilled. The clamps also are removed at this stage of the journey and returned on a small truck to the point where the molds are assembled. Both of these features are shown in the illustration Fig. 3. At one time dry sand basins made in the coreroom were used exclusively. It is claimed that the green sand basin is just as satisfactory, besides representing a considerable saving in time, sand and oven space. The sand in the dry sand basin only served once, then it was thrown in the discard. The green sand is used continuously.

Blocks of iron in the runner basins are removed and loaded into steel pans mounted on trucks which carry the loads to the elevator near the

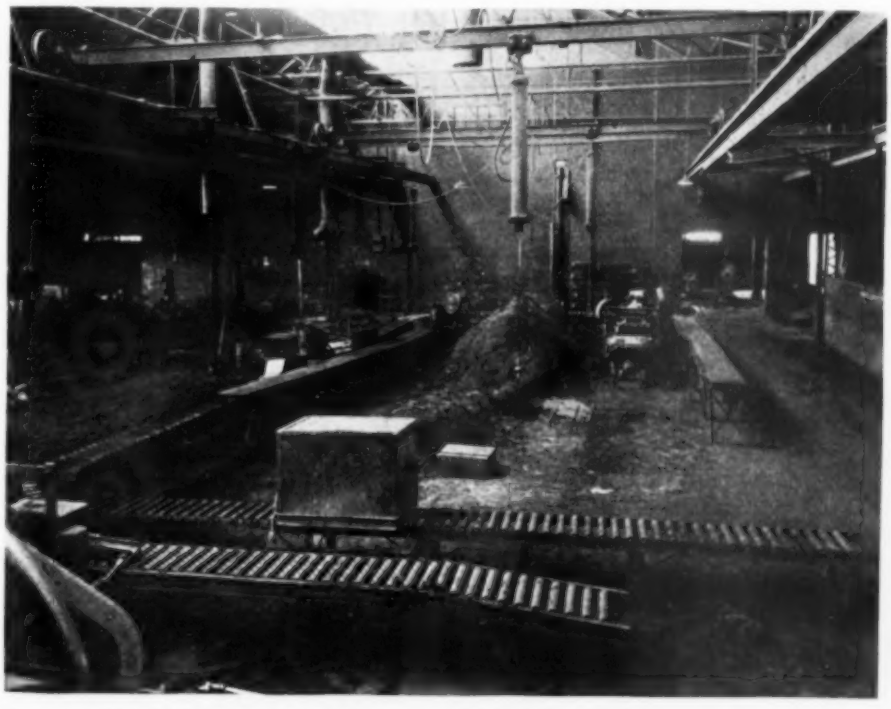


FIG. 6—ONE OF THE EARLY GRAVITY CONVEYORS IN USE BEFORE THE PRESENT EQUIPMENT WAS INSTALLED

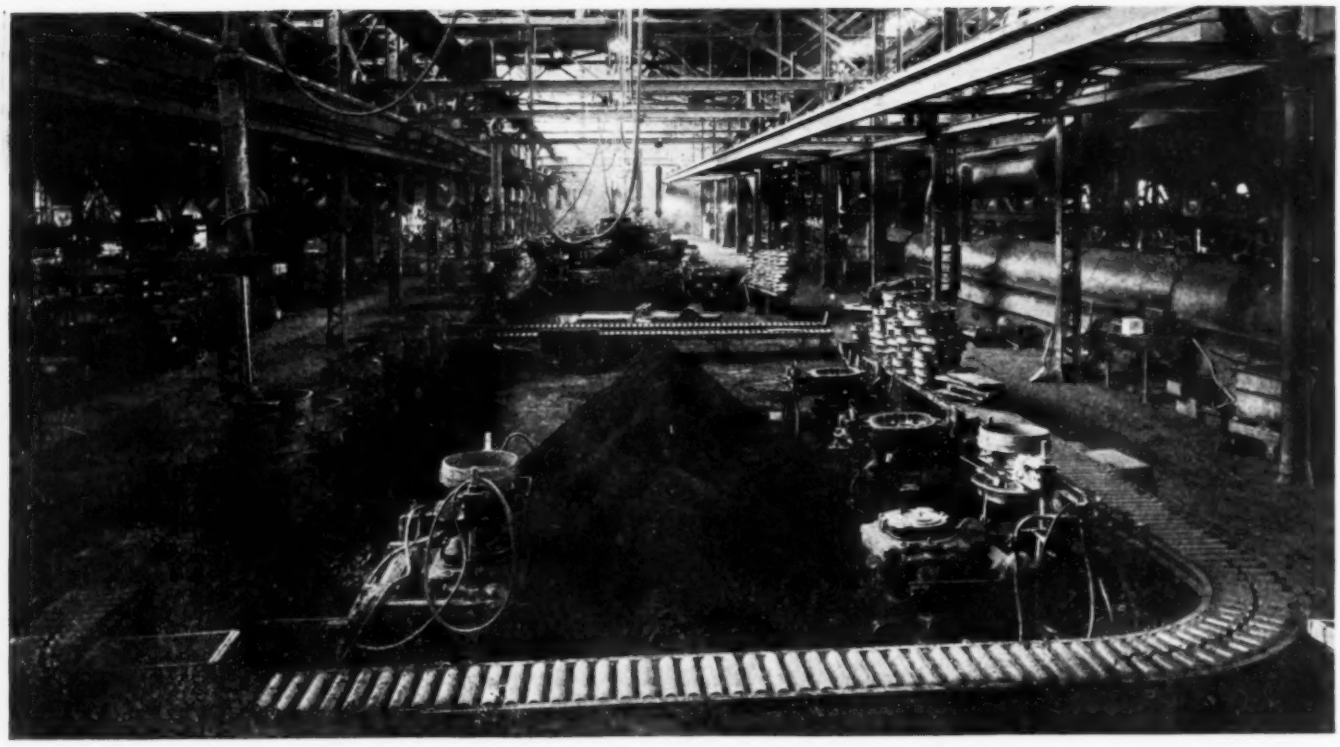


FIG. 7—MOLDS FOR TRANSMISSION GEAR CASTINGS ARE MADE ON TWO SHORT GRAVITY CONVEYORS NEAR THE CENTER OF THE SECOND BAY IN THE FOUNDRY

cupolas. The elevator takes the trucks to the upper charging floor where all the shop scrap is stacked according to the floor on which it was produced. With a knowledge of the material used in the various charges on the preceding day, the metallurgist may incorporate the shop scrap intelligently from day to day. Cast-iron pig molds mounted on swivels are provided at several points as indicated to the left center in Fig. 3 for the reception of any iron left in the ladles on their way back to the cupolas or from the ladles employed in pouring the molds. Blazing hot iron is one of the most essential features in the production of thin castings. Therefore, the iron from the cupola is tapped each time into a clean, hot ladle, and the ladles used for pouring the molds are completely emptied before receiving a fresh charge.

Sand mixing and distributing equipment is shown in outline in Fig. 2, where it may be noted that 3, 4 and 5 are duplicates of each other, while 1 and 2 are served from a single bin. Sand from the shakeout is taken aloft, passed through a revolving screen which removes pieces of core and other hard lumps and then through a special wheel developed by the C. O. Bartlett & Snow Co., and incorporated in all sand mixing installations. The sand is thrown through a circle of rods at the rim of the wheel from whence it falls into an elevated bin with a holding capacity of 75 tons. It is claimed that the wheel effectually mixes and aerates the traveling sand.

Sand from the bottom of the bin is distributed by an overhead flight conveyor that extends over the battery of hoppers that serve the molding machines. An ingenious type of reciprocating cutter under the bin shaves a definite amount of sand from the bottom each time it passes back and forth and deposits it on the conveyor which supplies the molding machine bins or magazines. The knives in this cutter may be adjusted to varying heights and in this manner the amount of sand deposited on the conveyor may be regulated or adjusted to meet changes in operating conditions. Sand which is carried over the end of the conveyor and other sand spilled on the floor is shoveled through gratings in the floor on to a reciprocating conveyor which carries it back to the sand mixing station where it once more is incorporated in the mixture. New sand is added at the shakeout station, partly to rejuvenate the sand, but principally to make up for the loss of sand carried away on the castings.

Sand Is Pumped

Formerly all the sand knocked off the castings in the preliminary cleaning room was shoveled through gratings in the floor upon a moving belt which carried it through an opening in the north wall of the building. From this point it was loaded on trucks and conveyed to various points on the company's property where it was dumped. Fortunately the surface of the ground was low in many places, therefore it could receive a great quantity of waste sand without showing any great change in topography.

Some time ago a better plan was adopted for the disposal of waste sand. In the passage as far as the north wall the original plan still is in force. Beyond that point the procedure has been modified to a considerable extent. A pan conveyor discharges the material into a crusher. A magnetic separator removes all the iron, steel scrap and rods and the sand falls into a pit where it is kept in constant agitation by a 5-inch stream of water introduced under pressure at the bottom. The thin slush is pumped through a second 5-inch pipe with an intake located in the tank and an outlet several hundred feet away at a point on the property where a great quantity of material may accumulate before it rises unduly above the level of the roads in the vicinity. The pipe is mounted on low horses and is flexible to the extent that additional lengths may be added from time to time and the nozzle may be deflected to discharge the thin mud in any direction.

Up to the present no attempt has been made to recover any of this sand for use in the foundry, but the subject is receiving consideration. Owing to the thorough and intimate mixing of the core and molding sand in its passage through the water tank and the pipe and the subsequent aging of

(*Concluded on Page* 478)

Making a Pattern for a 14-Inch Double Helical Roll Pinion

By J. G. Fitzpatrick

ACCURACY is the prime requisite for all patterns, yet all patterns are not accurate. However, owing to necessity, some must be made as accurately as the material and human skill will permit. In the latter class may be included a cast toothed gear wheel. If we are able to confine the error within close limits, the pattern will fulfill its most important requirements, such as a true pitch diameter, chord pitch, and tooth profile, for upon these depends the efficiency under working conditions.

A typical design for a double helical roll pinnion is shown in Fig. 2. Where a cast toothed gear may be used advantageously, this is the standard style. The tooth profile was laid out with an odontograph, whose formula comes as near as possible to an involute curve laid out by rolling the pitch circle above and below the pitch line. If this method is followed carefully a comparatively even and smooth working contact will result.

After making a full sized working layout, and since the pattern must be parted on the vertical center line, the symmetry of design, in the similarity of its opposing component parts, is apparent. The pattern is made up of two main body blocks shown in Figs. 3 and 4; two simillar shrouds shown at Fig. 5, the necks illustrated in Fig. 6, and which are facsimilies, and lastly the wobblers in Fig. 7, which are identical. Each of the teeth is of the same size, and the face is struck with the same radius and from the same equidistant point on the pitch line. The flanks come under the same category, for they are struck from the same equidistant point on the construction circle which is 5/16-inch above the pitch line. The roots of the teeth have a ¼-inch radius on either side. Throughout the building of the pattern, this repetition of duplicate operations will be self evident, and if these are performed in an intelligent and systematic manner,

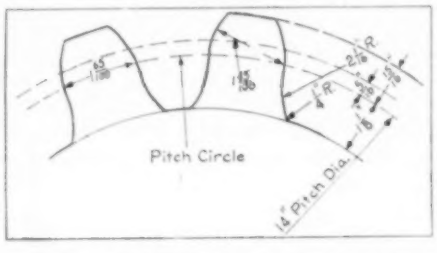


FIG. 1—DIMENSIONS OF THE TEETH

much valuable time will be saved, and the pattern not only will be built in the least possible time, but also with the additional satisfaction of knowing that it is as accurate as may be made by human skill.

The pattern blocks, shrouds, necks and wobblers are made of thoroughly seasoned dry pine. They are built up by the segmental method, that is, several layers are used, each divided into quarters. By the overlapping of the joints, like bricks in a wall, an ideal job is made of the wobbler.

Templates are made for each set of segments according to the dimensions. The number of pieces required are marked and all the band sawing is done at one time. The blocks, Figs. 3 and 4, contain seven rows 1⅛-inch with four segments to the row, making 28 segments the block. Since two blocks are required, 56 segments will be needed. The shrouds, Fig. 5, require two rows each ¾-inch thick with four segments to the row. Therefore eight segments are required for one shroud, and sixteen are needed for the two segments.

The neck, Fig. 6, is composed of nine rows, each 1⅛-inch thick, with four segments to the row. Thirty-six segments are required to each neck, and 72 segments are used for the two necks. The wobbler consists of seven rows, each ⅞-inch thick, with four segments to the row. Twenty-eight segments are used in one wobbler and 56 are used in both. These parts are built to their respective sizes and glued. The joints should be well made and thoroughly clamped, and the parts then set aside to dry.

Twenty-six blocks are required for the teeth, each block 9½ x 2½ x 2½ inches. Since the pattern is to be first class, these should be cut from straight grained mahogany, as shown in Fig. 10.

The main body blocks, Figs. 3 and 4, are prepared to receive the teeth by having an iron face plate fastened to the end of each block. The block

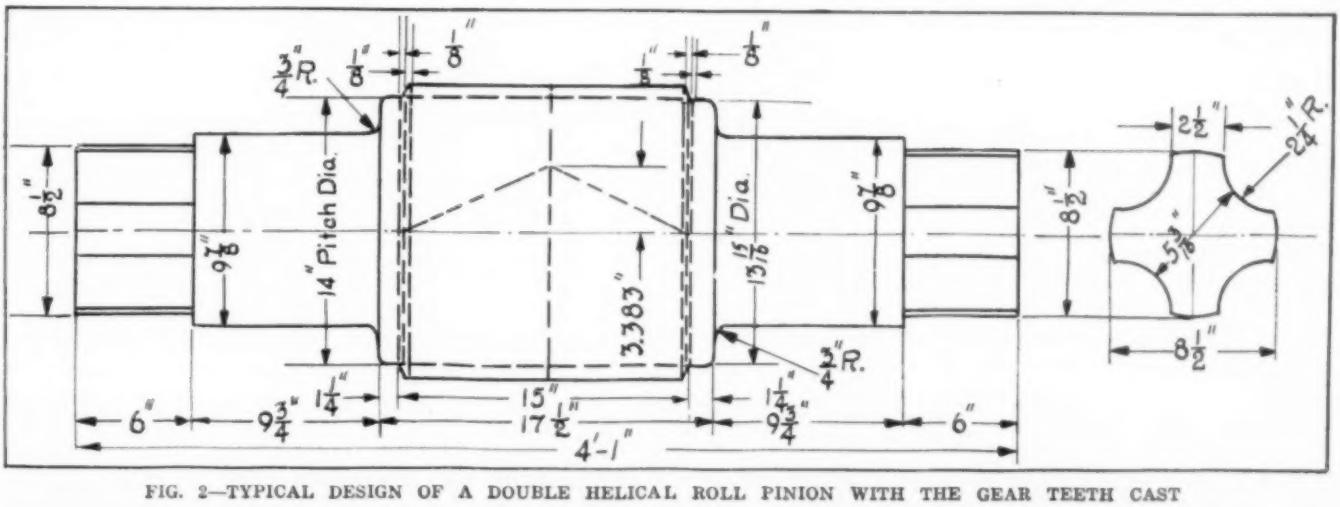
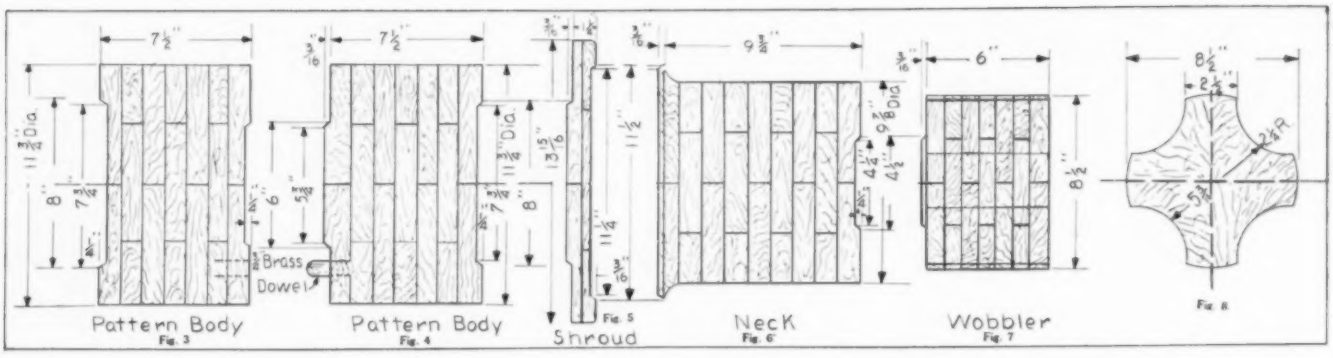


FIG. 2—TYPICAL DESIGN OF A DOUBLE HELICAL ROLL PINION WITH THE GEAR TEETH CAST



FIGS. 3 TO 8—METHOD OF CONSTRUCTING THE VARIOUS COMPONENT PARTS OF THE PINION

shown in Fig. 3 is placed in the lathe, and is turned down and finished to 11¾-inch diameter. The front end counter-bore is bored ¼-inch deep, 7¾-inch diameter at the bottom and 8 inches at the top. A center is made with the point of the dividers, the block is sand papered, and given one coat of orange shellac. When dry, the block is smoothed with fine sandpaper and removed from face plate. The remaining block, Fig. 4, is mounted and turned to the same dimensions, finished in the same way and removed from the face plate.

A wooden chuck about 10 inches in diameter is fastened to the iron face plate. The chuck is faced back to a depth of 3/16-inch leaving a projection 8 inches in diameter. This is chamfered so that it is a tight fit into the counter bore on block, Fig. 3. After centering the block, it is secured to a wooden chuck from behind with two wood screws. The block is faced to 7½ inches, long counter boring the face ¼-inch deep, 5¾ inches diameter at the bottom and 6 inches at the top. A center point, is marked and the piece shellacked, finished and removed from the lathe, leaving the face plate still attached. A wooden chuck is turned with a projection chamfered the same way and attach the block shown in Fig. 4. The block is faced back to 7½ inches long, but a projection 3/16-inch thick and 6 inches in diameter is left. This projection is chamfered until it is a neat fit into the counter bore in the block illustrated in Fig. 3. This forms the joint of the main pattern. The two blocks thus placed together will make a 15-inch face with each end counter bored to receive the projection to be turned on to each shroud, Fig 5.

Each shroud is fastened in turn to a face plate 6 inches in diameter. The shroud is turned to 13 15/16 inches in diameter, the front is faced, the front corner is rounded to a ¼-inch radius, and the piece is counter bored for a depth of three-sixteenths to 11¼ inches diameter at the bottom and 11¾ inches diameter at the top. Without rechucking the shroud, but by working from behind, it is faced back to 1¼ inches thick, leaving a projection 3/16-inch thick, 8 inches at the bottom, and 7¾ inches at the top. As previously stated, this should be a neat fit into the counter bore in the blocks shown in Figs. 3 and 4. The shroud then is sanded, shellacked and finished. The other shroud is turned to the same size in the same way.

In turning the necks Fig. 6, it is more convenient although it requires a little longer time, to counter bore the face first, rechuck on this and turn the fillet end afterward. This makes a neat fit of the fillet into, and with the face of the shrouds. The iron face plate is fastened to one end of the piece which is faced and counter bored ¼-inch deep to 4¼-inch diameter at the bottom and 4½-inch diameter at the top. The piece then is shellacked, finished and removed from face plate. The other neck is turned in the same manner. A wooden chuck about 9 inches in diameter is fastened on the face plate. A projection 4½ inches in diameter is turned by facing back for a depth of 3/16-inch. The projection is chamfered until it is a tight fit into the counter bore on the face of the neck, and then is secured by screws from behind. The neck is faced to 9 15/16 inches in length. The diameter is turned to 9⅞ inches, leaving a ¾-inch fillet on the outer end. A feather edge should not be turned on the fillet, but a thickness of 3/16-inch should remain, which is chamfered to a diameter that will fit into the counter bore on the shroud, thus making a perfect blend with its surface. The other neck is turned in precisely the same way and is shellaced and finished.

The face plate is attached to the wobbler, Fig. 7 and the piece is faced to 6 3/16 inches. A projection 4½ inches in diameter is turned by facing back for a distance of 3/16-inch and this is chamfered until it is a neat fit into the counter bore in the face of the neck. The piece is turned down

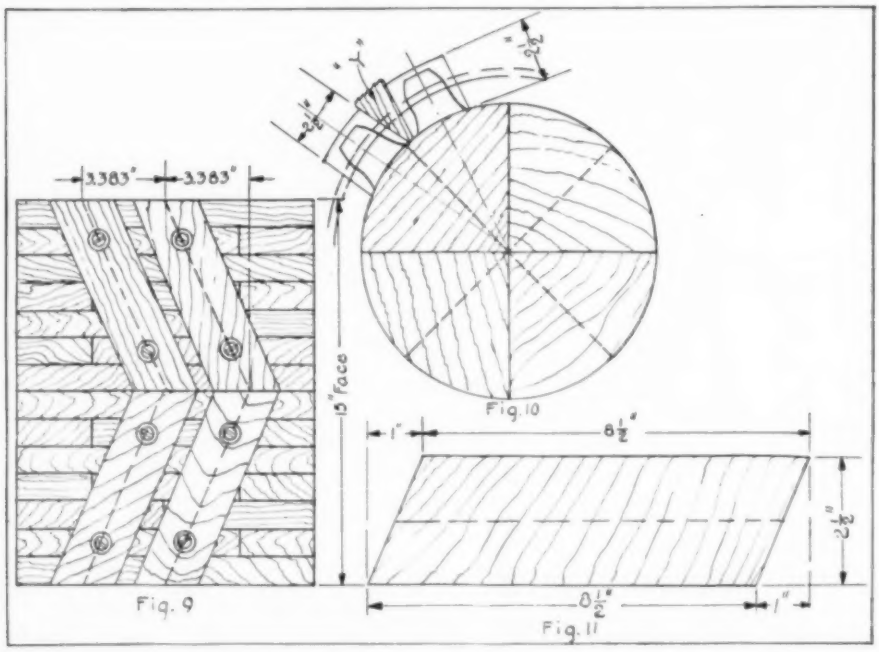


FIG. 9—THE HERRINGBONE PATHWAY. FIG. 10—METHOD OF ATTACHING TOOTH TO THE BLOCK. FIG. 11—THE TEETH ARE MADE OF MAHOGANY BLOCKS

to a diameter of 8½ inches and sanded and finished. The other wobbler is turned to the same dimensions.

The blocks Fig. 3 and 4 are prepared for the teeth by uniting the blocks with a ¾-inch brass dowell in the joint. The socket in block, Fig. 3, and the pin in block, Fig. 4, are placed so as to keep a level joint. The purpose is obvious when pattern is being rammed up in sand. The iron face plates, which still are attached, will prove convenient in handling. The block, Fig. 3, is placed in the lathe, and while in motion, a line is marked on its outer diameter with a pencil. This line is divided into thirteen equal parts. A bevel is set to a distance equal to the hypothenuse of a triangle whose base is 7½ inches and whose height is 3.383 inches. With this bevel lines are drawn through the thirteen points thus showing the angle of the teeth. The block, Fig. 4, is placed in position and the lines are carried across its face, thus forming the herring bone pathway, Fig. 9. Each of the 26 mahogany blocks, Fig. 11, must be fitted on to main body. A strip of wood about ¾-inch wide and ¼-inch thick is fastened along one of the 13 lines, the surface chalked well and the blocks fitted with a round sole plane and gouge. Two holes are counterbored with a ½-inch center-bit and from the flat side of the tooth block, about 1½ inches from either end and about ¾-inch deep. The hole is continued with a shell bit to suit a No. 14 wood screw. The tooth blocks are attached to the main pattern by setting each with one side on the diagonal lines, and securing them temporarily with the screws, Fig. 9. A V-shaped white pine wedge about ½-inch thick is glued, between each of the tooth blocks and at both ends, Fig. 10 at Y. This ties all the teeth blocks together and enables the outer diameter to be turned to size without jarring or chattering the blocks. It also gives an even surface to locate the centers in laying out the profile of teeth.

While the glue is drying on the main patterns, the outline as shown in the plan view is marked on the face of the wobblers. The piece is cut with a band saw and finished to the line.

The block, shown in Fig. 3, then is placed in lathe, and the tips of the teeth are turned to their diameter and each side of the pattern faced. The 14-inch pitch circle is marked on each face with the dividers, as is the construction circle for striking the flanks of the teeth. Beginning at the center of one tooth block and on the pitch line, 13 equal spaces are marked off with the dividers set to 3.383 inches. If this is done accurately these points will strike the center of each remaining block. The block, Fig. 4, is placed in the lathe and the same operations repeated. A line then is made with a knife edged scriber on all four faces from the center of each block and through each of the points in the center of the teeth. These lines are connected on the outer diameter.

When marking the profile of the teeth, it is more convenient to mark each separate part on all the teeth before going to the next dimension. Thus, from the center the thickness of the tooth, which is given as 1.65 inches, is marked. With a radius of 1.45 inches, all the faces are marked from one side. From this side and with the same radius all the faces are marked on the opposite side. With the dividers set to a radius of 2 1/16 inches and at a point on the construction line, all of the flanks are marked from this side. With the same radius, but from a point on the construction circle at the opposite side, all the flanks are marked on the opposite side. With a radius of ¼-inch, the fillet is marked on both sides at the root of the teeth. The V-shaped pine wedges are cut with tennon saw, the screws removed from a tooth which then is finished with plane, gouge and chisel. Each tooth is marked with a number and a corresponding number is placed on the block. This will enable the patternmaker to locate its place when all are finished and ready to be glued back again on to pattern. After finishing the two halves of pattern they are assembled and the tooth profile of one compared with the other at the joint. These should match perfectly.

In assembling the complete pattern it is best to insert a brass dowell between each section thus keeping the wobbler wings in the same plane. The parts are given two coats of shellac, and the necessary lifting and rapping plates attached. The castings are made of steel, molded on end using a drop gate at the side and a sink head at the top.

Careful There, Brother!

How often, when we cross the street, or hazards in the shop do meet, our minds are wandering from our work and all our safety senses shirk, somebody gives a warning shout, "Hey, Buddy, watch your step; look out!" We stop and look with foolish grins and dodge in time to save our skins.

'Tis not alone the brainless fools who disregard the safety rules. The careful man will sometimes slip; he needs a friendly warning tip when he forgets that danger's near, or ignorance prevents all fear.

Bill's mind is at the baseball game while Bill is underneath a crane. Give him a warning loud and clear to catch his inattentive ear. He'd surely do the same for you, or any member of your crew.

Co-operation oft you've heard in safety sermons on that word. But getting down to simple facts, it's made of kindly deeds and acts. You help your pal and he helps you; that's fellowship and safety, too.—C. T. Fish, Editor, *National Safety News.*

French Foundrymen Elect

At the special meeting of the Association Technique de Fonderie held in the rooms of the association at 15 Rue Bleue, Paris, France, Leon Thomas, director of the Citroen Foundries, was elected president. Jean Derdinger, Syndicat General des Fondeurs de France; H. Magdelenat, managing director, Ste. des Usines de Rosieres, and E. Roncerat, Bonvillain & Ronceray, were elected vice presidents. Emile Ramas, retiring president, was given the title of honorary president and Joseph Leonard, former vice president of the Belgian section of the association, was elected an honorary member.

The various committees presented reports covering their activities during the past year, dealing with technical training, apprentice training, study of sand, refractory materials, pig irons, and the standardization and manufacture of patterns. Mention was made of the second International Foundrymen's congress to be held in Detroit in September.

Tells How Precious Metals Are Cast

At the recent meeting of the New England Foundrymen's association held June 9 in Boston, Arthur C. Godfrey, Gorham Mfg. Co., Providence, R. I., spoke on the molding practice used in casting precious metals in plaster molds. James C. Higgins, sales manager, George Ide & Co., Troy, N. Y., gave a discussion of sales considerations.

INTEREST in the future of lead, tin, zinc and aluminum base alloys is connected closely with the development of the die casting process. Casting in permanent molds under pressure is assuming more importance daily, and attempts constantly are being made to broaden the scope of this process. The article is from a paper presented at a meeting of the Chicago section of the American Society of Mechanical Engineers. The author is vice president of the Stewart Mfg. Co., Chicago.

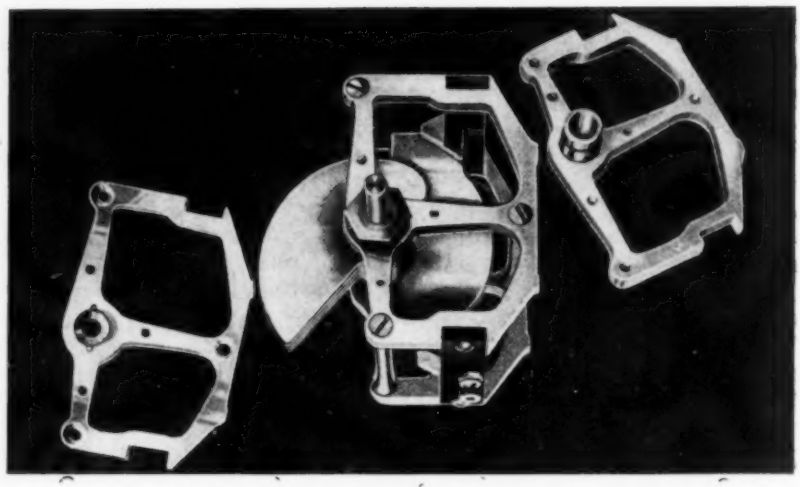


Fig. 1—Many Parts Used in Radio Manufacture Are Die Cast

Fundamentals of Die Casting

By S. A. Hellings

CASTING metal in material other than sand often is termed *die casting*. Babbitt metal hand-poured into permanent iron molds, brass poured into plaster of paris molds, and aluminum fed by gravity into iron or steel molds often is called die cast. However, in this article the discussion is limited to the strict application of the term, which involves the process of casting metals in permanent dies under comparatively high pressure.

As indicated by this definition, die casting has its limitations. In the first place the size of the part that may be die cast is limited by the machine. Castings now are being made which weigh 10 to 20 pounds apiece and the maximum is increasing daily. The shape of the casting to be made also is a limiting factor. Thus far the only alloys successfully die cast on a commercial scale are those which melt at temperatures below about 1400 degrees Fahr. It is necessary to consider the suitability of the alloy to the job before deciding on die casting certain parts.

Unless a given part is to be produced in quantity, die casting cannot be considered. The dies are relatively expensive and as the die cost must be prorated on the total number of castings, it becomes less and less important as the number increases.

The first and probably the most important step in making a die casting is constructing the die. The parting line of the casting must be decided upon, the cores must be located so that they shall pull out by the simplest method and the runners, waterways, gates and vents properly located. The latter two items are the most important. Since the metal in the casting solidifies in a few seconds after it has filled the die, the gate must be of such shape and in such position that the flow of the metal is smooth and even, avoiding pockets, swirls, and other irregularities which would mar the smooth surface. The vents must be located so that all the air in the die is driven out ahead of the metal, or else blow holes or trapped air pockets will show up in the casting. The fact always must be borne in mind that this extra metal in gates and vents must be trimmed off the finished casting and consequently they must be kept to a minimum.

Die Is Stationary

In one type of die casting machine, which is shown in Fig. 2, the lower half of the die is stationary and is rigidly attached to the frame *A* of the machine. The upper half *C* of the die is attached to sliding head *E* which is actuated in suitable guides in the frame by the toggle linkage *F* and piston of the air cylinder *D*. When the dies close (they are held together under heavy pressure) the cores *G* and *H* move transversely on the carriages *I* and *J*, and assume their proper position in the die. At the same time the metal pot *K* is moved transversely into such position that nozzle *L* registers with the gate in the die parting and presses tight against the die. The valve *M* is then opened, a sufficient length of time is given to allow enough molten metal (contained in metal pot *M*) for a single casting to enter the chamber *N*. Valve *M* is then closed and air under about 300 pounds per square inch pressure is applied to the opening *O*. This forces the metal in *N* out through the nozzle *L* and into the die under high pressure. The die is vented to permit the air contained in it to escape so that the metal entirely fills the open space in the die. The die is watercooled and consequently the metal freezes almost instantly. The machine is then reversed, the metal pot moved back, the cores moved outward, and the die opened. Into the latter are fitted ejector pins which conform to the shape of the die when the latter is closed but which automatically move inward as the die opens and force the casting free from the die after which it is removed by hand. The dies are occasionally lubricated to prevent the metal from sticking. The first casting made after lubrication is usually imperfect and is therefore rejected.

The position of the core carriages *I* and *J* and the metal pot *K* is controlled by levers. The position of the latter is in turn controlled by cams (some of which are not shown) while the dies are opened and closed by pneumatic means. The cams are attached to a shaft or shafts which are in turn driven by belts from shafting which usually is under the floor.

In case it is desirable to have the metal in the casting extremely dense as in the case of a bearing, the pressure on the metal entering the bearing is increased. In this case a piston is employed in the metal cylinder within the metal pot, and this piston is actuated by a second piston of larger diameter on which air pres-

sure is applied. A pressure of about 1000 to 1500 pounds per square inch is used in casting bearings.

The alloys used in die castings are of four types. The lead base alloys are probably the simplest. They consist of lead alloyed with tin, antimony, copper or bismuth. A typical analysis is that corresponding to S. A. E. specification No. 14 consisting of 75 per cent lead, 10 per cent tin and 15 per cent antimony. Lead alloys are comparatively soft unless the proportion of alloying element is so large as to make them become brittle. In general the ultimate compressive strength ranges from 10,000 to 20,000 pounds per square inch and the yield point from 2000 to 6000 pounds per square inch. A brinell hardness of from 10 to 40 can be obtained. The specific gravity of lead alloys is high, ranging from 9.60 to 11.40, which is pure lead. Lead alloys are among the best to use where resistance to corrosive agents is the most important feature as they are not affected by salt water or moist air conditions. Lead alloys are used mainly for cheaper bearings and such parts as small water pump vanes, counterweights, etc.

The tin base alloys are the most expensive and are used only where some other alloy would not do the work. They consist of tin alloyed with one or more of the following elements in varying proportions: Copper, lead, antimony, bismuth. A typical tin base alloy is that corresponding to S. A. E. specification No. 11 which consists of 5.75 per cent copper, 6.75 per cent antimony and 87.50 per cent tin. Tin base alloys, like lead, are soft but are considerably tougher. Their compressive strength usually runs from 12,000 to 20,000 pounds per square inch, ultimate, and 4000 to 6000 pounds per square inch yield point. The brinell hardness range is from 15 to 30 and the specific gravity from 7.25 to 8.30. The use of tin base alloys is limited practically to food container parts and high grade babbitt bearings.

The zinc base alloys have been the most widely used for die castings. They are composed of zinc alloyed with copper and tin or with copper and aluminum in varying proportions. A typical analysis is copper 3 per cent, tin 6 per cent, aluminum 2.5 per cent and the balance zinc. Another is copper 3 per cent, aluminum 4 per cent and the balance zinc. Zinc base alloys are strong and in some cases tough but in other cases brittle. Their tensile strength ranges from 20,000 to 40,000 pounds per square inch with from ½ to 2 per cent elongation. Their range of brinell hardness is from 35 to 80 and their specific gravity from 6.20 to 6.85. Zinc base alloys, if improperly made are harmfully affected by moist air conditions but if correctly made moisture and heat have practically no effect. They are largely used for automobile radiator caps, for instance. If the alloys are not true, the castings under the conditions of heat and moisture swell and grow and finally disintegrate. This phenomenon does not occur in all zinc base alloys, but appears only in zinc alloys containing alumnium in the presence of other impurities.

Aluminum base alloys have been the latest alloys successfully diecast and it is in this field that a great future lies. They consist of aluminum alloyed with one or more of the following elements in varying proportions: Copper, silicon, zinc, nickel, manganese and magnesium. An alloy which is die-cast successfully and which has excellent properties consists of 2½ per cent copper, 3 per cent nickel and the balance aluminum. Aluminum alloys can be made with an ultimate tensile strength ranging from 18,000 to 30,000 pounds per square inch with an elongation of from ½ to 5 per cent and a brinell hardness of from 45 to 100. The specific gravity ranges from 2.60 to 3.10.

These properties are in the cast condition. Heat treatment of aluminum castings of certain composition corresponding to the duralumin type will increase the strength way above these figures, but so far this heat treatment has been applied mainly to wrought aluminum or to special sand cast parts.

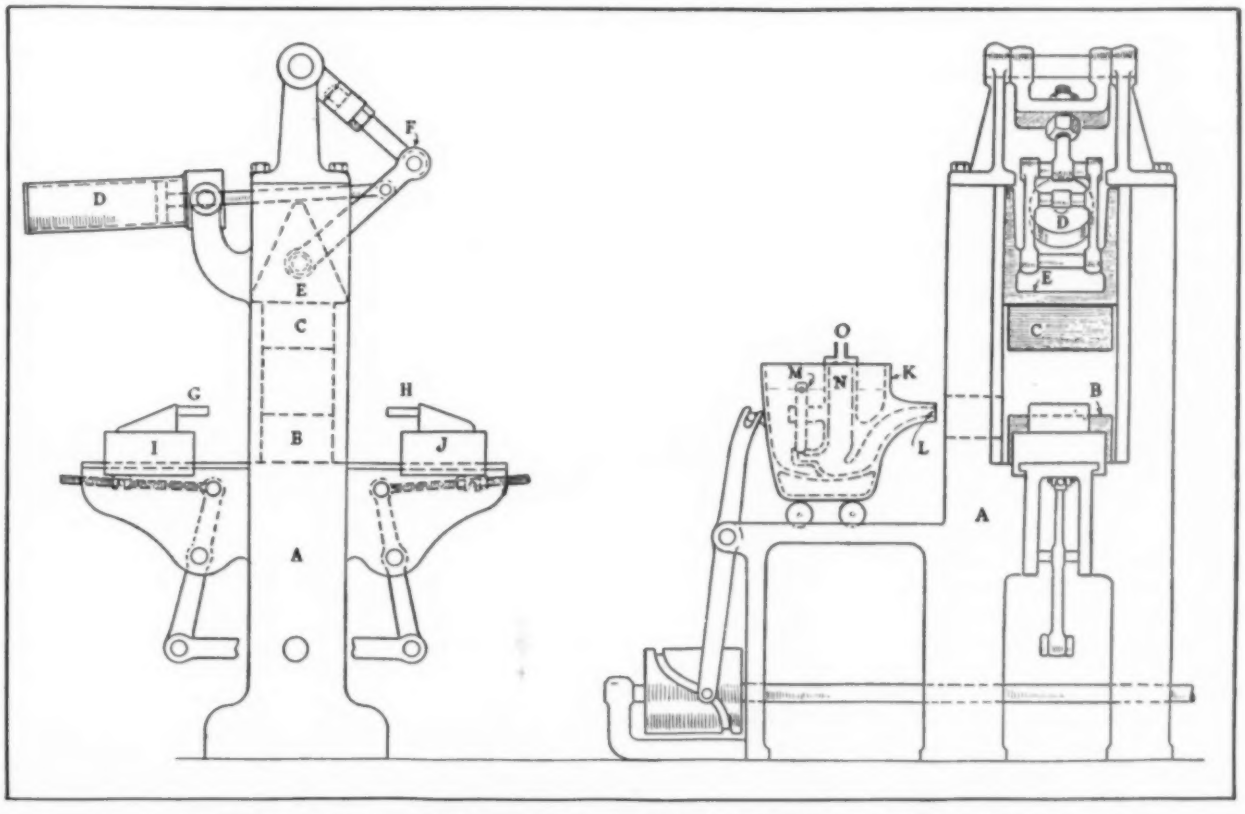


FIG. 2—DIAGRAM OF THE VERTICAL TYPE OF DIE CASTING MACHINE SHOWING PRINCIPAL PARTS

How and Why in Brass Founding

By Charles Vickers

AluminumCausesTrouble

We are sending you a sample cut from a casting of red brass showing a condition that causes us considerable trouble. While this sample was cut from a small bushing, the type of casting is not material as the castings crack in flat work as well as cylindrical. This metal consists of miscellaneous scrap to which is added a few ounces of phosphor copper per hundred pounds. We melt in oil-fired, non-crucible furnaces and have tried different pouring temperatures. We have no trouble with such alloys as gun metal or phosphor bronze, it seems to be confined to the red brass.

The metal as shown by sample contains a large proportion of nonmetallic material, so much so, in fact, that it fails to be held in solution but rises to the surface of the metal as the latter cools. We will imagine a bushing to be poured that has been molded to be cast in the vertical position and has been gated at the bottom.

As the molten metal rises gently in the mold the nonmetallic content keeps floating out until the top surface is completely covered and the dross forms a bridge between the mold walls, at which point it sticks, but the pressure behind the rising metal breaks this bridge in places, and pushes it upward in others. Where the break occurs the metal wells upward, and holds the dross, and when the casting is machined the fault formed by the dross is exposed, and there lies what has been termed a *crack*, which is really not a crack, but a line of dross forming a parting in the metal.

The above gives the cause of the *crack*. Now why does the metal carry so much dross? Because the metal contains impurities that may act to produce dross when it is melted. It is difficult to state positively from observation of a small sample of solidified metal whether the dross exists as such within the metal, or is formed as the castings are poured. It is probably both, and we may mention that had the sample been machined entirely, it would have been impossible to determine just where the difficulty lay. Forturately the part next to the core was not machined, and this surface tells the story completely.

The trouble maker is aluminum, and it looks as though it was assisted by silicon. All that is necessary is bronze and other alloys containing aluminum to get sound castings. The aluminum may also be eliminated during the melting operation, but the method of working to accomplish this is not generally known. Miscellaneous scrap is a dangerous material in these days of aluminum bronze and silicon bronze and other alloys containing either aluminum or silicon, or both and which cannot be detected after being machined or scrapped.

One way of getting around the difficulty is to discard the use of such scrap, and use all new metals.

Pressure Causes Leaks

We have been casting bronze elbows weighing 4 pounds each and with ¾-inch of metal around the core and have experienced much trouble due to leakage under 500-pound air pressure, after they have been machined and then brazed onto a tube. The alloy is copper 88 per cent; tin 6 per cent; zinc 4 per cent, and lead 2 per cent, and the strange part is that the castings show no signs of porosity under a magnifying glass either as cast, or after machining has been done. Inspection after the brazing has been done shows no tendency toward burnt metal, but about 50 per cent of the castings leak, and another strange thing is that out of the same heat, some are satisfactory, others not.

The fact that the castings do not exhibit signs of *porosity* means nothing as far as resisting pressures is concerned for the metal thickness may be bridged here and there by particles of dross, or openings between the crystals may be present, due to the drainage of the eutectic of the alloy to lower parts of the castings. It appears strange at first thought that in the same heat, some are good and some are bad, but there is a good reason for this condition. It may be due to ill-advised methods of skimming the pots or ladles, for after a mold has been poured some metal may string from the pouring lip, and when cleaned by the skimmer fall into the yawning sprue of the next mold. This film breaks up but does not melt in the stream of metal because it is insulated by an oxide film so wherever it is washed in the casting, there will be a weak spot which may continue entirely through the thickness of metal. Watch this point. Another thing in pouring a heat, some of the molds are poured hotter than others, and some of the castings of the cooler poured molds will fail to resist pressure. Be careful to pour all the molds at what may be termed a lively heat, even though the castings are fairly heavy.

These matters should be given careful attention, but the odds are heavily in favor of internal shrinkage due to failure to put on sufficiently heavy sprues connected to heavy runners, so adjusted as to feed metal to the castings, which means the runner must be on a higher level than the casting. Many brass founders make the mistake of putting runners lower than castings, and thereby ensure a nice, fine, solid runner at the expense of the casting. With these elbows it is better to have a higher re-melt of sprues and runners than to lose half the work done, so put on a 5-inch cope with a high runner, and a sprue or a riser or feeder large enough to supply plenty reserve metal to insure the shrinkage drawing on the reserve, instead of the reserve drawing on the castings. Then the crystals will be solidly bedded in the eutectic, and the structure of the metal will be impermeable to water or gases under pressure. A metal thickness of ¾-inch ought to be ample.

Casting Must Expand

We are making a hose coupling that has to expand into another casting so it can swivel. We are using a formula of 82 per cent copper; 9 per cent zinc and 9 per cent lead, but this is too soft, and many of the castings break when expanded. We would like to obtain a formula that would not break and one that is not quite so soft. The casting is 2.25 inches inside diameter, and 3.25 inches outside diameter and must expand to 3.5 inches.

The following formula will be found satisfactory; Copper 82 per cent; zinc 8 per cent; lead 8 per cent, and tin 2 per cent. A yellow brass such as the following alloy would be cheaper; Copper 70 per cent; tin 1 per cent; zinc 27 per cent; lead 2 per cent.

Bill Describes a Long Cylinder Core

By Pat Dwyer

HAVE you ever noticed" said Bill the other night, "How a stray item in a newspaper sometimes attracts your attention and changes your opinion on a certain subject?"

"Well," I hedged cautiously. "Yes and no. Most of what I read leaves no impression of any kind. At one time I believed everything I read, but I have seen so many stories contradicted one day that were published as absolute 100 per cent truth on the preceding day that I have grown exceedingly skeptical. I read a newspaper now in the same manner and for the same reason that I read any kind of fiction; purely for entertainment. Whether the stories are true or false is a feature which does not insterest me. For example I read on one page that one of our superheroes accompanied by his personal valet, 17 trunks and a pair of wolf hounds has just sailed on the MAURETANIA for an extended tour of Europe. On another page of the same paper I learn to my surprise that the same hero is busily engaged in California supervising the production of positively the greatest film of his career, a smashing masterpiece based on the immortal story *The Babes in the Wood*, to be released under the title *Kiss Me Again*. If I am not unduly inquisitive or if the inquiry does not violate any confidence might I ask what prompted the question? In a word and to be brief, what's on your mind?"

"Well," said Bill, "I'll tell you, although to be strictly honest under the circumstances, man to man and all that kind of thing, I don't think the information will do you any good. I can see plainly that you are all set for an argument and if there is one thing I hate more than another it is to get mixed up in an argument with a bird who is not ready or willing to listen to reason. When I find that I am wrong I always—"

"Sure," I jeered, "I kown all about you when you are wrong. Oxen and wain ropes won't jar you from your position. The well known British bull dog or a porous plaster are only pikers in the class of clingers when compared to the manner in which you stick to an opinion."

"As you were," said Bill. "In other words pipe down and give a guy a chance. If the civil little question I asked gets you all excited I would hate to stick around if some person asked you a real impertinent question. What I had in mind was an item I read in the paper today about Russia. Up to the present I held the popular view of all those whose knowledge is based on what they read in the papers. Russia is a proverty stricken land, a land of red ruin and desolation where famine stalks by day and marauding bands of robbers finish the dirty work by night. A land where the male portion of the population goes unshaved and unshorn for lack of the price, where the women lie hidden for want of clothing and where the children fight with the dogs in the street for possession of a crust or a bone.

YE EDITOR IS CONFRONTED BY VOX POPULI

"This item I read today has convinced me that all these reports are pure bunk, that is if any kind of bunk may be called pure. By a singular coincidence I read several other confirmatory items in tonight's paper and I saw something downtown today that removed any lingering doubts I may have entertained on the subject."

"Go ahead," I said. "Shoot my brave mujik. I suppose now you intend to let your hair and whiskers grow until you resemble a skye terrier. You will buy yourself a sheepskin coat and a pair of long boots and learn to sing the *Volga Boat Song*."

"No," said Bill. "In fact NO twice. You are hopping off on the wrong foot as usual. I have no intention of adopting Russian clothing or of going to Russia to live, although mind you if I was 30 years younger I should be strongly tempted to give the place a whirl. Russia today is where the United States was at the close of the Civil war, but with every prospect of forging ahead much faster in the immediate future."

"Bill," I said suspiciously. "Have you been toying with a bottle of vodka?"

"No," says brave Bill. "Although like our mutual old friend what's-his-name-Barkis, I'm willin'. Listen to what these lawyer lads call the accumulated evidence and see what you make of it.

"In one paper I read that the Russian government has placed a contract with a prominent American firm for a $1,000,000 dredge to be used for dredging gold in the Lena river in Siberia. In a second paper I read an item to the effect that the same government has opened negotiations with the General Electric and the Westinghouse for a $100,000,000 power project on the Dneiper river designed to electrify Moscow and other towns. Samuel Vauclain of the Baldwin Locomotive Co., has

gone to Russia for a month. In the window of a downtown bank I saw a silver cup about 3 feet high and ornamented with jewels, presented to the White Motor Co., Cleveland as the first prize in a recent motor truck contest staged in Russia and participated in by manufacturers of motor trucks from every country where these vehicles are made.

"You can't tell me that hopelessly impoverished countries are in a position to order $1,000,000 dredges. A country that is down and out does not go around dangling $100,000,000 jobs in the air. Monsieur S. Vauclain is an experienced traveler and usually manages to make his expenses with enough on the side to pay the boy who carries his sample cases containing an assorted collection of locomotives, plain, fancy and mountain type. Truck contests are not held in places where there are no roads or where the people do not need them.

"Russia has a population of nearly 200,000,000, almost twice as many as continental United States. Until comparatively recent years progress as measured by our standards was slow. The country was self contained and isolated by barriers of language, habit and custom. All that is changing rapidly. Means of rapid communication, postal facilities, telephone, telegraph, moving pictures and radio during the past few years have practically completed the job of showing one-half of the world how the other half lives.

"Some day in the near future Russia will present a practical illustration of Kipling's famous remark about the colonel's lady and Judy O'Grady. The people see pictures of the pleasures, conveniences and luxuries enjoyed by the inhabitants of other more favored lands and they will begin to wonder why they cannot have these things for themselves. Wonder will turn into desire and desire gradually will crystallize into concerted action. History of all great movements proves that when desire is strongly enough aroused some means will be devised for gratifying the passion. If the colonel's lady can wear silk stockings, Judy O'Grady if necessary will move heaven and earth to secure a similar covering for her own shapely limbs.

"Russia may be behind the world in some respects, but in certain phases of foundry practice she hung up records that never have been equalled. The great 200-ton bronze bell of Moscow probably will stand forever as the climax of the bronze founders art and it is almost certain that the 600-ton gray iron anvil block cast 60 years ago near Odessa in the Crimea never will be duplicated. Some of the most beautiful and intricate castings in bronze and iron found in museums and private collections all over the world were made in Russia.

"Talking about difficult castings reminds me that the last time I was over here I was commenting on the method of making a long cylinder on end in a shop where the head room under the crane was limited. I outlined a method for making the mold, but you interrupted me before I had a chance to describe the making of the core and the assembling of the mold.

"Two methods are available for making the core as a unit instead of in two parts. A two-part core might be employed with a male and female joint, but since it is more difficult to make and set than a one-piece core and besides increases the hazards incident to the job, it is not worth considering in this instance.

"In the first method a thickness of loam is swept on a steel pipe or a cast-iron barrel, liberally provided with vent holes and wound with hay rope. In the second method the core first is made in two longitudinal halves on cast iron arbors and then bolted together before it is placed in the mold. Where the barrel is employed, a spider is bolted in the upper end and the lower end is closed with a cast-iron plate covered with short dabbers on the outside to hold a pipe must be screwed in a liberal distance to insure rigidity. The pipe is cut to the proper length so that the end will rest on the spindle socket in the drag *iron to iron*. Where a cast iron arbor is employed in a dry sand core the upper end is provided with suitable hooks for lifting the core on end and a stout projecting member on the lower end of each arbor is adjusted to rest on the spindle socket.

"All things considered the steel barrel is preferable to the cast-iron barrel. It can be assembled readily from one length or from two sections of pipe held in the center by a union. It is only half the weight or less of a cast-iron barrel and the cost of drilling the vent holes will not be as great as that of coring the holes in a cast-iron barrel where half of the holes will have to be punched through after the casting is stripped from the sand. Even with the most modest equipment, considerable expense is entailed in molding a 12-inch barrel 20 feet in length. In a cast-iron pipe that length made in green sand the bottom is apt to strain or the core is apt to shift a trifle. In either case the pipe will warp out of a straight line on account of the uneven thickness of metal and will render the sweeping of a straight core either extremely difficult or impossible. The only advantage of a cast-iron barrel is that it is more rigid than a long steel barrel and therefore is preferable for a job to be cast horizontally. In the present instance that condition does not obtain and the steel barrel is sufficiently rigid for the purpose.

Can't pull any high hat stuff on these birds

"The only pattern equipment required for making the dry sand core is a frame conforming to the outside shape of the core and a pair of strikes, one the size of the main barrel and one the size of the neck. Each is provided with a shoulder at each end to ride on the frame. The arbors are made in open sand molds in the usual manner by placing the frame on a prepared level sand bed to serve as a guide. The longitudinal members and the cross ribs are stamped in the bed and a curved stick or rod is employed to coating of loam. A piece of extra-heavy, 4-inch steel pipe is screwed into a suitable boss in the center of the plate to carry the neck of the core and also serve as a core print and support. Manifestly this

pierce a row of long curved dabbers along each side. Three steel loops are cast in the arbor for lifting the core while in a horizontal position.

"It is not necessary to ram a solid, dry-sand core. A hollow core will require less sand, will dry quicker and will facilitate the passage of the vent while the mold is filling with iron. The center may be filled with large lumps of coke, but a better way is to build a row of bricks on end down the center before ramming the sand. After the half core has dried it is rolled on its back and the bricks may be removed.

A LITTLE INNOCENT RECREATION ON THE VILLAGE GREEN

"In making the core, the frame is laid on the plate and filled to a depth of 1 inch with core sand. The arbor is bedded down in the sand and the strike is run over the top to see that none of the curved ribs or loops project above the surface of the proposed core. The bricks then are built loosely and four gate sticks are adjusted upright and equidistantly to form openings for the bolts to be inserted later to bind the two halves of the core together. Sand is rammed to the approximate shape and finished to size with the strikes. The second half may be built in a similar manner on a plate or may be built directly on top of the first half after it has dried. In the latter instance the bricks cannot be removed, therefore it is advisable to use coke instead of the bricks.

"Some foundrymen prefer to ram sand on a barrel in preference to covering it with loam. The barrel is laid on the core carriage and the frame is blocked in position flush with a center line on each side. Sand is packed over half the circumference of the barrel and struck to size. The frame then is removed and the sand is dried. Afterward the core is rolled over and the second half is built in a similar manner. The principal advantage of this method is that it reduces handling to a minimum. The entire core may be built right in the oven.

"Only a comparatively small number of foundries are equipped with ovens long enough to dry a core of this kind. Therefore the core will have to be dried one half at a time. The core is shoved into the oven as far as it will go and the remainder projects outside. The door of the oven is lowered until the bottom touches the core and the remainder of the opening may be closed temporarily with pieces of sheet iron. After the first half is dried the core is reversed and the second half is dried in a similar manner. Needless to say the core must be dried thoroughly for a job of this kind to prevent the metal from fluttering.

"When the time comes for assembling the mold, the procedure will vary a little depending on whether the core is made on a barrel in one piece or on a pair of arbors in two halves. The one piece core is ready as it leaves the oven. The two part core must be rubbed to a bearing, bolted together and the joint daubed with slurry. The cavities over the bolt heads and the loops are packed full of sand and dried. This job usually may be done with a torch, but a more satisfactory job may be done by running the core into the oven for an hour or two.

" With everything in readiness, the first section of the cheek mold is placed on the drag in the bottom of the pit. The core is laid down by the crane with the small end projecting over the pit. The main hoist of the crane is attached to the upper end of the core and the auxiliary hoist is hooked to a suitable rope sling near the lower end. A few old bags may be wrapped around the core at this point to prevent the rope from chafing the core. As the upper end of the core is raised, the lower end gradually is lowered into the pit until the entire core swings clear suspended only from the upper end. Then the lower sling is disengaged and the core is lowered the remainder of the distance into its print. A handful of slurry is placed in the bottom of the print to seal the opening in the 4-inch pipe.

"In the event that the crane is not equipped with an auxilliary hoist, a block and tackle may be suspended from the bridge or a temporary winch may be rigged in the vicinity. The core is braced temporarily in an upright position and the crane is disengaged from the top. Then the various sections of the cheek are lowered over the core into place with a little paste or slurry on the joints to insure a tight fit. Clamping the flask, adjusting the top ring core, fastening an anchor across the top of the core and making up the basin are matters of ordinary routine and require no comment. However, the anchor must be released immediately after the casting is poured to allow the core barrel to expand.

"The ram for this casting may be made horizontally in a skin dried mold. The core may be in one piece or in two parts with the ends butted together in the center. If the chaplets are tinned, the casting will not leak. The best method of pouring the casting is through a row of small pop gates on the top. From 10 to 20 per cent steel may be added to a mixture to conform to the following analysis: Silicon 1.50 per cent, sulphur 0.10 per cent, phosphorus 0.50 per cent, manganese 0.75 per cent."

"The plan sounds all right in Eng lish" I said "but you certainly have my sympathy if you ever try to translate it into Russian."

"Good night" said Bill "That would be a real job."

Sends Out Questionnaire

To obtain the consensus of opinion held by interested parties, the committee on foundry practice which is working in conjunction with the department of commerce on the advisaability of showing the approximate weights of castings on blue prints or inquiries sent to foundries for quotations, has decided to send out a questionnaire. This questionnaire will be sent to both foundrymen and to purchasers, and it will inquire into the advantages to be derived by the seller and buyer in the proposed plan.

A Correction

Through an error in a descriptive article on the Cadillac plant, Detroit, which appeared in the May 15 issue of THE FOUNDRY the ladle carrying cranes made by the General Electric Co., Schenectady, N. Y., were credited to another firm.

European Foundrymen Plan American Trip

BY VINCENT DELPORT
European Manager, THE FOUNDRY

ARRANGEMENTS are well advanced for the departure from European shores of the foreign delegation which will attend the Detroit foundry convention. The majority of delegates will travel in one party, leaving by the S. S. LANCASTRIA of the Cunard Co., Sept. 11 and due in New York Sept. 20. Continental visitors will sail from the French port of Havre, while the British foundrymen will sail later in the day from Southampton.

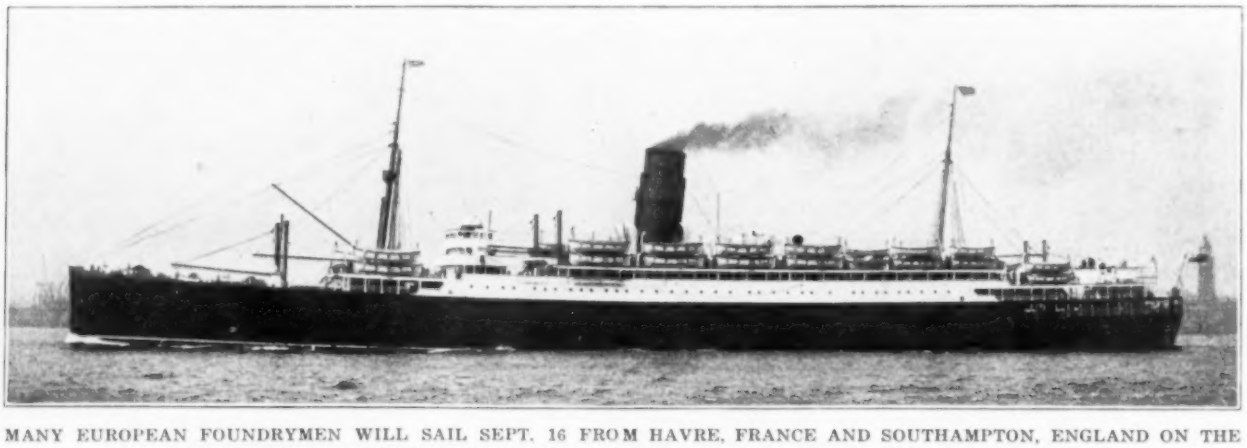
It is expected that a dozen countries will be represented, including Great Britain, France, Belgium, Italy, Czecho-Slovakia, Germany, Spain, Switzerland, Holland, the Grand-Duchy of Luxemburg, Sweden and Denmark. A provisional reply-form also has been received from a foundryman in Ukraine. The European delegates are expected to number about 125, including ladies. Such a diversity of nationalities and languages necessitates careful organization, both for leaving Europe and arriving in the United States. Everything is being done to insure the comfort of the visitors by representatives of the American Foundrymen's association on both sides of the Atlantic. The material details of the voyage for the main party are being arranged by Messrs. Thos. Cook & Son, Ltd.

Although the majority of delegates will travel on the LANCASTRIA, a group of German foundrymen will cross on a German liner sailing direct from a German port. This will obviate the necessity for these visitors having two extra vises on their passports, since, if sailing from Havre, they would have to cross the borders of Belgium and France to reach Havre.

After attending the convention and exhibition the European visitors will make a tour of inspection in the principal foundry districts of the United States, including Philadelphia, Buffalo, Detroit, Pittsburgh, Cleveland and Chicago. Sightseeing trips to Washington and the Niagara Falls will be arranged.

Exchange papers will be presented at the convention by the foundry associations of Great Britain, France, Belgium, Germany and Czecho-Slovakia.

Some of the intending visitors, including Professor Pisek of the High Technical School of Brno, Czecho-Slovakia, and T. J. Brons, foundry proprietor, Appingedam, Holland, will leave Europe about July to make an extensive tour of the United States.



MANY EUROPEAN FOUNDRYMEN WILL SAIL SEPT. 16 FROM HAVRE, FRANCE AND SOUTHAMPTON, ENGLAND ON THE S. S. LANCASTRIA TO ATTEND THE INTERNATIONAL FOUNDRYMEN'S CONGRESS AT DETROIT

Costs Show Lower Trend

(*Concluded from Page* 468)

the sand under the influence of the weather, the total amount of bond has been redistributed uniformly through the mass. To the casual glance and feel the sand has every appearance except color of a natural molding sand freshly dug from the bank or pit.

Pressing need for some time has been the development of methods for securing a daily heat of 600 tons. This involved the installation of a considerable quantity of new equipment and the employment and education of a greatly increased staff of employes. An organization of that kind and under those conditions does not settle down and function smoothly over night. The management confidently anticipates that all the loose ends will be gathered up and tucked away in the near future and then attention will be given to the problem of utilizing the spent sand on the dump.

This is the second article by Mr. Dwyer on the gigantic foundry of the General Motors Corp. at Saginaw, Mich. The third will appear in an early issue.

The Superior Steel Castings Co., Benton Harbor, Mich., has changed its name to the Superior Steel & Malleable Castings Co., to better identify itself with its products.

Fire-Clay Brick Described in Circular

A brief history of the manufacture of fire-clay brick, the growth of technical research, and the industry in the United States is given in circular No. 282, bureau of standards, Washington. Essential information dealing with the manufacture, classification, properties, and uses of fire-clay brick also are given. In addition, the United States government master specification for fire-clay brick and a list of the principal references to literature on the subject are included.

Mounting Patterns Requires Varied Ingenuity-II

By H. N. Tuttle

MOST of the molding machines developed in late years require a pattern with the cope half mounted on one plate and the drag half upon another. The essential requirement is that the pattern parts shall be mounted in the same symmetrical relation to the flask pin holes, with the cope accurately located *opposite hand* to the drag, so that the castings will show no shift.

As it is exceedingly difficult to locate the pattern parts by centerlines, drill the flask holes to measurements and secure a perfect match, some other method of locating is advisable.

As a general rule it is better to drill the flask pin holes in the pattern before mounting the pattern. The same template is used for drilling both pattern plates and flasks. The patterns then are mounted starting from these flask pin holes. If the pattern is split, the dowel pin method often may be used to advantage.

One half the pattern first is located upon the plate with due regard to gating, sand room in flask, etc. If the flask is ready the cope half should be located first, to get the best location for the pattern in the flask bars. The cope half pattern is clamped in position, and two or more dowell pin holes are drilled through the pattern and plate. After the pattern is removed the cope and drag plates are placed face to face, with tight fitting pins in the flask pin holes. The mating dowel holes then are drilled through the drag plate, using the holes just drilled in the cope board for a template. With the two pattern halves together the drag pattern is drilled through the cope dowel holes. The patterns then may be screwed or bolted permanently to their respective boards, with the assurance that there will be a perfect match. Should there be any cheek parts, the same process may be carried through them, but extreme care has to be used to get the drilling perfectly square. The frame method, given later, is better for several part jobs.

The template method often is used. It is particularly adapted to plates where cope and drag pattern halves are mounted side by side, and where cope and drag molds are alike. One whole pattern is sufficient to make two castings per flask. The pattern plate is prepared with flask ears and the flask pin holes are drilled by template, say a piece of tire iron 4-inch x ⅜-inch and of sufficient length, as shown by the dotted line Fig. 20. After the pattern parts are drilled for dowels, one half is located upon the template, so that it will come in the desired position in the flask. The template is drilled, using the pattern half for the drill jig. The template is held properly in position by tight fitting pins in the flask pin holes, and the pattern dowel holes drilled through the pattern plate *A* and *B*. The tire iron template is turned over end for end, bottom side up and two holes are drilled in the other end of the pattern plate, which will be symmetrically located in relation to the first pair. The two pattern halves now may be fastened permanently to the plate.

Use Pin and Hole Method

It will be noted that when the cope and drag are mounted side by side in the general relation shown in Fig. 20, the flask has to be turned end for end in theory. In practice, the drags might be rammed, the pattern plate turned around, and the copes rammed, when the flasks could be turned crosswise, if it were worth the trouble. However, in this type of mold the practice often is to use a pin on one end of the flask and a hole on the other, which absolutely prevents a mistake in closing.

Long narrow patterns may be located, cope and drag side by side, cope and drag alike, as in Fig. 22, and still roll the flask crosswise. In this case a round pin and hole in one end of the flask and a flat pin and slotted hole in the other end makes the best equipment.

Four patterns per flask may be mounted nicely by the template process by using a wider template plate and by turning the template both endwise and crosswise. The template must be turned opposite side up when drilling for the opposite half pattern.

Another style of template with a wider range of usefulness is shown in Figs. 23 and 24. Fig. 23 shows its simplest form made of so-called 1-inch lumber well fastened at the corners. The edges of the material are planed square. Its use is shown in Fig. 22, which represents the cope and drag halves of the same pattern mounted symmetrically upon the centerline, cope and drag alike. The notch *V* is placed tightly against the flask pin, the other leg of the frame touching the other pin. The half pattern is located on the board as desired and the blocks *F*, *G*, and *H* are fastened to the frame. These blocks are used to locate this half of the pattern on the board. The frame then is turned over in the same direction as the flask rolls, i. e., crosswise and the opposite half pattern located again the same blocks, *F*, *G*, and *H* and fastened to the board. The patterns are located without the use of any accurate dimensions yet they are placed as the feeling method will permit. The feeling method generally is considered the most accurate of any ordinary shop methods. Of course inside and outside calipers, feelers, etc., may be used.

Sometimes the flask pins are placed in some unusual locations as in Fig. 22, due for example to the barrel core projecting through the flask at the normal pin location. A square frame may be made with a thin piece of steel nailed to the frame to fit over the flask pins, as at *N*, Fig. 25.

Where the cope and drag patterns are entirely unlike in contour, they cannot be located by the feeler system, but must be mounted to centerlines. This frame makes the most convenient and accurate tool for locating center-lines on two pattern plates, exactly symmetrical to the flask pins. Four blocks are fastened on the inside of the frame, *I J K L*, Fig. 24. The lines are drawn with a temporary wood straight edge, shown by dotted line. By turning the frame in the same direction the flask turns, the centerlines are bound to coincide.

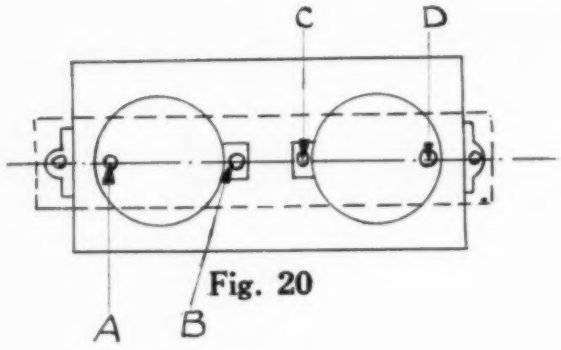
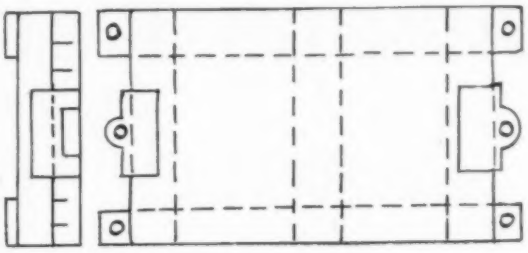


Fig. 20



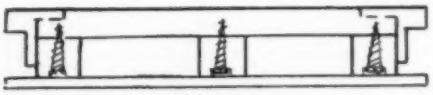


Fig. 21

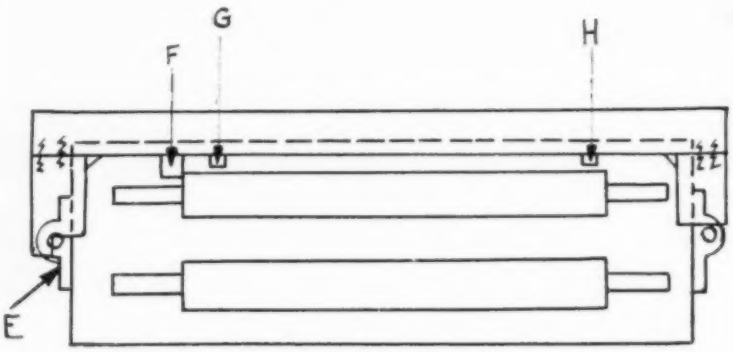


Fig. 22

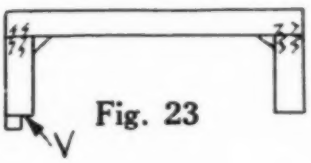


Fig. 23

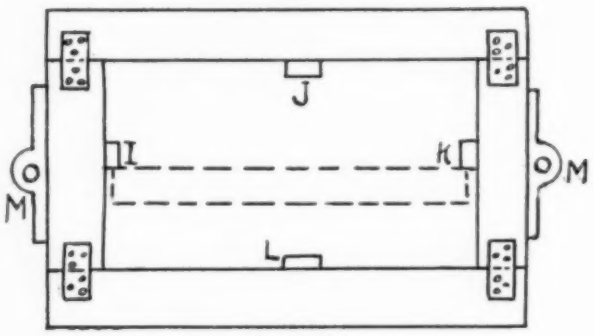


Fig. 24

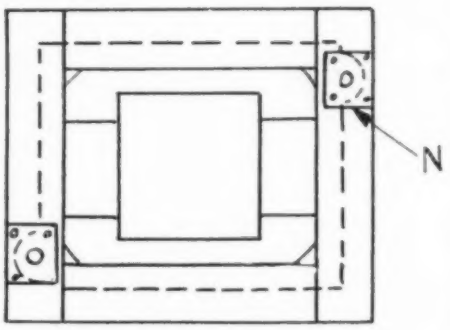


Fig. 25

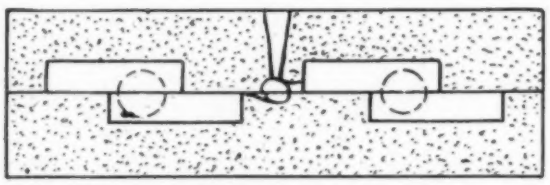


Fig. 26

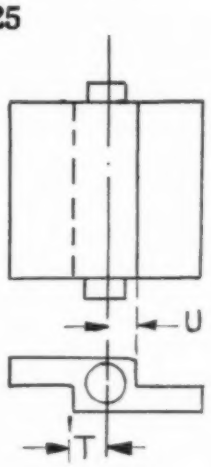


Fig. 29

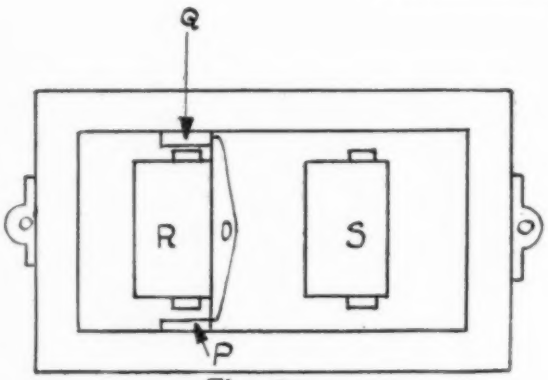


Fig. 27

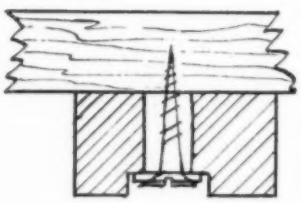


Fig. 28

FIG. 20—METHOD OF LOCATING TWO HALVES OF A SYMMETRICAL PATTERN ON A PLATE. FIG. 21—TYPICAL WOOD PATTERN MOUNT. FIGS. 22, 23 AND 24—RIGS FOR LOCATING COPE AND DRAG PATTERNS. FIG. 25—WHERE THE PINS ARE OFF CENTER. FIGS. 26, 27 AND 29—LOCATING TWO PATTERNS IN A SINGLE MOLD. FIG. 28—DETAIL OF CLEAT AND BOARD

If there is much mounting of this kind to be done, it is advisable to make a pair of cast iron ears, *M M*, Fig. 24, with holes lined with hardened bushings. If stiffly made, the frame with these ears may be used for drilling the flasks. The ears can be screwed to any temporary frame, and easily may be removed for the next job.

Check The Work

These frames are especially valuable for checking old patterns or finished work, where the dowel system cannot be checked readily. For finished work generally it is only necessary to use a simple frame as Fig. 20, or even a board sawed out enough to pass around the pattern, and check with inside or outside calipers to corresponding parts of the two pattern halves.

Figs. 26, 27, 29 show an interesting pattern recently mounted by this system. The pattern itself is shown in simplified drawing in Fig. 29. The dimensions *T* and *U* are alike. It was desired to put two in a flask, use one board, cope and drag alike, requiring only one pattern. Fig. 26 shows the two castings in the mold. Fig. 27 shows the locating frame. Having decided upon approximate positions for the centerlines the blocks *P* and *Q* were fastened to the inside of the frame as shown. These blocks must be in length exactly *T* plus *U*, Fig. 29. Pattern *R* was located against the straightedge *O* as shown in Fig. 27. The frame then was reversed end for end and pattern *S* was located by reversing straightedge *O* to the opposite ends of the blocks *P* and *Q*. This is the reason blocks *P* and *Q* must be equal to length *T* + *U*, Fig. 29. The pin and hole system of flask pins prevents an error of closing. The endwise location of the patterns on the plate was determined by another block not shown on the sketch.

Sometimes when cope and drag are on different boards and the molder cannot tell readily which way the flask parts close, a mistake is made in closing, when the flask pin system does not prevent it. In a great many cases any error in closing can be prevented by placing the gates on the drag side of the pattern plate, and the runner, or skim gate or sprue boss on the cope. If cope and drag flasks are mismatched the casting cannot be poured. However, it is better in all cases to have a plain marker on every pair of pattern plates to indicate which way the flask parts go together. By having a uniform system of marking all pattern plates and having all plates marked whether necessary or not, the molders soon learn to identify these closing markers.

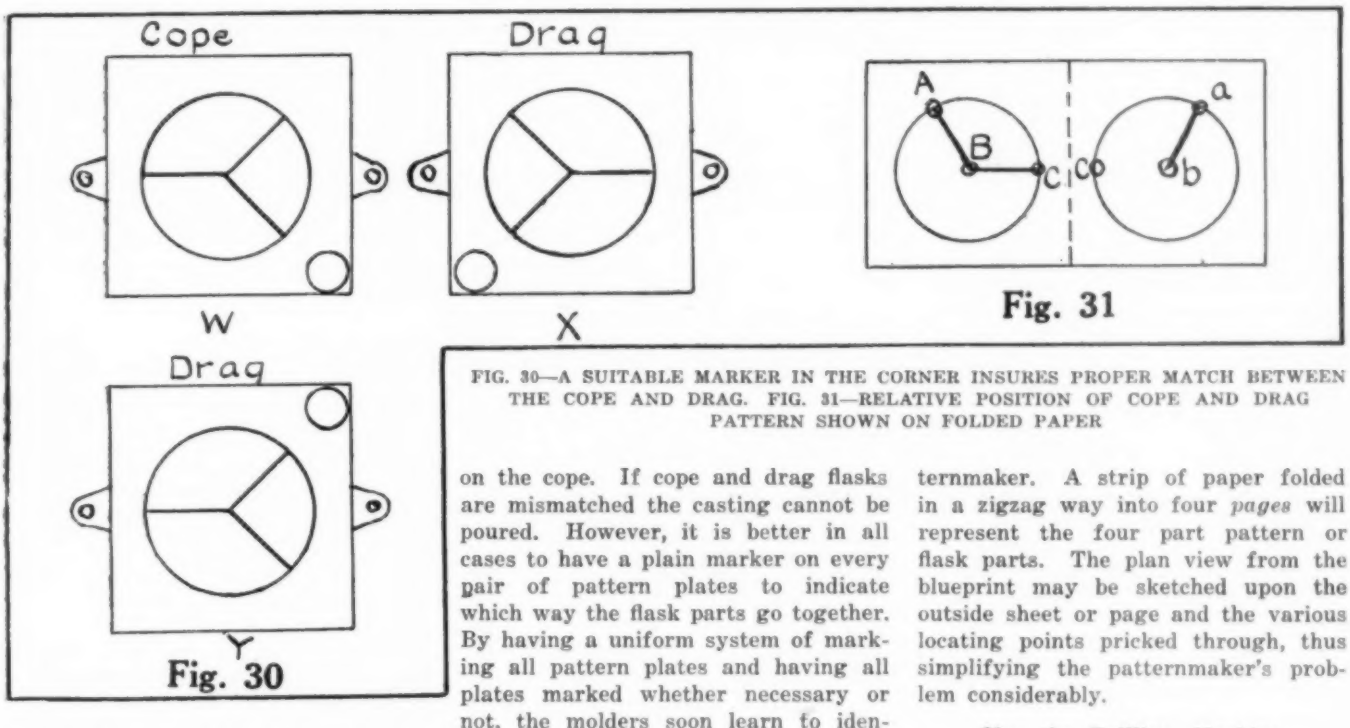


FIG. 30—A SUITABLE MARKER IN THE CORNER INSURES PROPER MATCH BETWEEN THE COPE AND DRAG. FIG. 31—RELATIVE POSITION OF COPE AND DRAG PATTERN SHOWN ON FOLDED PAPER

A boss placed on the cope board and a corresponding recess or countersink in the drag board, located in one out of the way corner of the flask forms a good marker. Fig. 30 shows a cope board *W*, with a drag board adjoining it in two different positions, *X* and *Y*. It can be seen that this type of marker shows the molder at a glance which way to close his flask. In case cope and drag are made from the same pattern board, a boss is used as this will cause no interference in closing, as would two countersinks. The boss may be a large oval head rivet, while a countersink can be made for drilling the recess.

Sometimes the patternmaker is confused when planning his work to visualize the proper position of the pattern parts upon their respective plates. A simple form of assistance in this line, and a great preventative of error is shown in Fig. 31.

Upon one end of a small piece of paper a sketch of the essential lines of the pattern is copied from the blueprint. The paper then is folded over at the dotted line. Care is taken to fold the paper in the same direction the flask is intended to roll. A pin is used to prick through the determining points through both thicknesses of paper. Thus *A B C* will prick through the paper to points *a b c*. From these pin points the opposite sketch is completed, which shows at a glance the proper position of the pattern parts. A double flanged wheel hub, with its variously located holes and bosses often confuses the patternmaker. A strip of paper folded in a zigzag way into four *pages* will represent the four part pattern or flask parts. The plan view from the blueprint may be sketched upon the outside sheet or page and the various locating points pricked through, thus simplifying the patternmaker's problem considerably.

Use the Drilling Machine

Occasionally it is impractical to drill the flask pin holes before the pattern-mounting. In these cases the plates should be drilled by the well known button and indicator method, generally upon a miller.

Plates for molding machine patterns usually are made of cast iron or wood, occasionally aluminum, brass or steel. The cast iron plates generally are made the shape and size of the outside of the flask, with bolting down ears for fastening to the molding machine platen. Sometimes they are provided with lugs or bails for clamping the flasks.

These plates should be made as thin as possible consistent with rigidity and strengthened with ribs after the manner of a surface plate. These ribs should be run at right angles to each

other rather than diagonally, as they are easier to make and mold. Bosses for the pattern fastening bolts, with wrench clearance, drill and top clearance, etc., should be arranged for on the plate pattern. There is much to be said in favor of wood plates, or pattern boards. They are cheaper to make and a great time saver in getting jobs started, as there is no waiting for making the pattern, getting a casting, and then getting it planed. They do not get peened out of shape as iron boards do, from the molder pounding them with a hammer. While they might not stand the wear so well as the iron, they will not break in two, as the iron plates do occasionally. Finally they form a buffer between the platen of the machine and the pattern and flasks. While there are many ways of making a molding machine board, the one shown in Fig. 21 probably is about the cheapest and best. After the board is planed to parallel thickness and cut to size it is weakened or sawed, as shown on the end view, by cutting rip saw slots nearly through the board about 2 inches apart. The cleats then are put on, with one coarse screw between each saw kerf. The detail Fig. 28 shows how these screws are placed through large holes in the cleat.

The screw is passed through a washer and when tightened is not drawn down too much; just enough to hold the washer snug to the cleat. In this way the board can go and come with the weather without cracking the board. The weakening prevents the board from warping. Good heavy planed cleats should be used. Iron plates are shown fastened to the bottom of the cleats for attaching to the molding machine platens. The writer has been using this type of board for over fifteen years without experiencing any trouble. The boards are ironed off with ⅛-inch band iron under the flask.

Faked Foundry Facts

A Spark Arrester

Publishes New Bulletin

Ventilation of buildings is an important problem. If there is a difference in temperature between the air in the building and the outside, there is a tendency for the air to flow through if suitable openings are provided. This movement is caused by the difference of pressure between the inside and outside and varies with different levels between floor and roof. The level at which the pressure within changes from less to greater than atmospheric is the neutral zone. The position of the neutral zone has been investigated by J. E. Emswiler and W. C. Randall and the results published in Engineering Research bulletin No. 3, issued by the department of engineering research, University of Michigan, Ann Arbor, Mich. By the concept of the neutral zone, ordinary laws of fluid flow can be applied to determine the volume of air movement for any distribution of area or window openings, or conversely the area can be determined for a given air flow. This bulletin may be obtained from the director, department of engineering research, Ann Arbor, Mich., for 50 cents.

Detroit Foundrymen Plan A. F. A. Entertainment

Plans for the entertainment of members of the American Foundrymen's association, visitors and delegates from foreign associations at the International congress in September rapidly are being developed by the members of the Detroit Foundrymen's association. Committees in charge of entertainment, plant visitation, hotels, publicity, transportation, reception, golf and ladies entertainment have been appointed as follows:

Entertainment Committee

W. J. Cluff, Frederic B. Stevens, Inc., Detroit, chairman; F. Dodge, Werner G. Smith Co., Detroit, vice chairman; W. J. Muhlitner, Great Lakes Foundry Sand Co., Detroit, vice chairman; P. W. Mulder, Almont Mfg. Co., Almont, Mich.; R. E. Prussing, Whiting Corp., Detroit; Vaughn Reid, City Pattern Works, Detroit; Clifford L. Snyder; Edward Strauss; A. E. Sweet, Port Huron, Mich.

Plant Visitation Committee

H. M. Lane, H. M. Lane Co., Detroit, chairman; H. W. Dietert, U. S. Radiator Corp., Detroit, vice chairman; G. Grimes, Grimes Molding Machine Co., Detroit, vice chairman; K. C. Babo, Dodge Brothers, Detroit; M. A. Beltaire, Jr., 805 Hammond building, Detroit; L. G. Blunt, Holmes Foundry, Port Huron, Mich.; G. A. Burman, E. J. Woodison Co., Detroit; R. Carolin, R. Carolin Brass Works, Detroit; J. W. Collins, U. S. Aluminum Co., Detroit; F. Cowen, Warner R. Thompson Co., Detroit; G. C. Curtis, Dodge Brothers, Detroit; F. Dodge, Warner G. Smith Co., Detroit; R. F. Flinterman, Michigan Steel Castings Co., Detroit; J. C. Green; F. Harrison, Sanford Riley Stoker Co., Detroit; P. J. McManus, Buhl Malleable Co., Detroit; M. T. Mortensen, W. W. Sly Mfg. Co., Detroit; J. A. Moore; J. A. Patterson, J. W. Dopp Co., Detroit; E. W. Pike, Detroit Steel Castings Co., Detroit; R. E. Prussing, Whiting Corp. Detroit; H. Rypsam, American Car & Foundry Co., Detroit; H. Rayner, Dodge Brothers, Detroit; C. J. Skeffington, Grimes Molding Machine Co., Detroit; H. B. Swan, Cadillac Motor Car Co., Detroit; W. R. Thompson, W. R. Thompson Co., Detroit; F. J. Walls, Wilson Foundry & Machine Co., Pontiac, Mich.; J. H. Ware, Bohn Aluminum & Brass Co., Detroit.

Hotel Committee

Wm. J. Muhlitner, Great Lakes Foundry Sand Co., Detroit, chairman; George A. Fuller, The Federal Foundry Supply Co., Detroit, vice chairman; R. Ronceray, Nicholls & Shepard Co., Battle Creek, Mich., vice chairman; C. W. Jinette, Norton Co., Detroit; E. J. Swink, Monarch Pattern Works, Detroit; J. W. Dopp, J. W. Dopp Co., Detroit; J. C. Woodison, E. J. Woodison Co., Detroit; F. W. Hamel; E. O. Book, Kelsey Wheel Co., Detroit; W. W. Bowring, E. J. Woodison Co., Detroit; H. P. McKinnon, Great Lakes Foundry Sand Co., Detroit.

Publicity Committee

J. J. Boland, Griffin Wheel Co., Detroit, chairman; J. W. Dopp, J. W. Dopp Co., Detroit; P. Lewis, *Iron Age*, Detroit.

Ladies Committee

J. L. Mahon, American Car and Foundry Co., chairman; Mrs. Lucia V. Grimes, vice chairman; Mrs. K. C. Babo, secretary; Mrs. Fred Erb, treasurer.

General Reception Committee

Mrs. Russell Scott, chairman; Mrs. C. J. Skeffington.

Transportation Committee

Mrs. K. C. Babo, chairman; Mrs. John Moore.

Entertainment Committee

Reception and tea, Monday, Sept. 27—Mrs. R. F. Flinterman, chairman; Mrs. F. B. Stevens; Mrs. Robert Crawford.

Luncheon, Tuesday, Sept. 28—Mrs. S. W. Utley, chairman; Mrs. Harry B. Swan.

Luncheon or Supper—Mrs. J. C. Woodison, chairman; Mrs. Chas. B. Bohn; Mrs. E. J. Woodison.

Gift or Souvenir Committee—Mrs. J. J. Boland, chairman; Mrs. H. Rypsam; Mrs. George Scott.

Transportation Committee

W. R. Thompson, Warner R. Thompson Co., Detroit, chairman; P. W. Mulder, Almont Mfg. Co., Almont Mich., vice chairman;

F. Dodge, Werner G. Smith Co., Detroit, vice chairman; Bernard Bathe, division passenger agent, Michigan Central railway; Fred A. Young, division passenger agent, Pere Marquette railway; Wm M. Klare, manager Statler hotel; P. G. Findley, traffic manager, Dodge Brothers; Frank Bromley, Detroit Foundry Co.

Reception Committee

C. M. Culver, Employer's association of Detroit, chairman; W. Pike, Detroit Steel Castings Co., Detroit, vice chairman; F. Tout, Griffin Wheel Co., Detroit, vice chairman; H. Rypsam, American Car and Foundry Co., Detroit; R. Carolin, R. B. Carolin Brass Co., Detroit; S. P. Thomas, Scott Valve Co., Detroit; T. W. Kirby, A. P. Wagner Co., Detroit.

Golf Committee

Fred Erb, Erb-Joyce Foundry Co., Vassar, Mich., chairman; Vaughn Reid, City Pattern Works, Detroit, vice chairman.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of The Foundry or of its editors.

Faces Touch on Outside

To the Editor:

In a recent issue of THE FOUNDRY an inquirer wants to know why the cope and drag faces of a mold made from a matchplate do not always *touch* properly. For example after sprinkling some white powder on the joint and trying the cope on and off he finds that the faces touch at certain points but apparently do not come into contact at others.

This condition is due to the uneven thickness of metal in the matchplate and this uneveness in turn is due to one of two causes. Either the matchplate has been strained in the pouring, or the cope face has sagged in the center. Molds made from a strained plate will touch on the outside but not in the center. Molds made from the second plate, that is the plate in which the cope has sagged a little will touch in the center but not on the outside. Where the discrepancy is not too marked the error may be overcome by a certain amount of hand tooling but usually the best method is to scrap the plate and make a new one. The error serves as a reminder to take greater care and precaution in making the second mold and in pouring the metal.

Yours very truly,
F. REINING

Toledo, O.

Desires More Specific Cost Figures

To the Editors:

The article on foundry costs by Albert E. Grover, and published in the April 15 issue of THE FOUNDRY was quite interesting, but I am at a complete loss to understand how he arrives at his melting costs, even after studying Table VI. Is this cost based on 8 tons of good castings, and how are the material costs and labor costs derived?

Frankly, I want to find out how to melt 8 tons of iron at a cost of $1.46 per hundred pounds with the price for delivered iron around $24 a ton at the present time.

Very truly yours,
C. E. HADDOCK.

Harrison, O.

Explains the Derivation of Melting Costs

To the Editors:

The interest of Mr. Haddock in the article on individual pattern costs is appreciated. The primary purpose of the article was to show methods rather than statistics. However, statistics in actual practice bear out the statements in the article and to give the derivation of material and labor costs, I submit the accompanying table and explanations.

The computations in the table are based on 8 tons of good castings a day, and a heat taken daily for 26 days in the month. All materials used in melting the iron, except those shown are included in the expense.

The labor charge is the amount paid to employes engaged in preparing the iron, coke, limestone, etc., for the cupola, running the iron into the bull ladles and other work in connection with melting the iron. All maintenance labor is charged to expense of the melting department when caused by it. The cost of labor for carrying the iron from the cupola and pouring into the molds is not a melting cost. Therefore, is not included with the melting, but is made a part of the molding department costs. Remelt is priced at a figure higher than the market price of scrap as it is considered more valuable than the run of scrap as purchased from dealers.

The foundry from which the data was obtained for the table given in this letter has a capacity for melting 20 tons a day.

Yours very truly,
ALBERT E. GROVER.

Berea, O.

Compares Steel and Iron

An interesting talk was heard by the members of the Quad City Foundrymen's association and the American Society for Steel Treating at the joint meeting held at the Blackhawk hotel, Davenport, Iowa, on May 20. R. W. Freeland, works manager, Hubbard Steel Foundry Co., East Chicago, Ind., spoke on cast steel, and made a comparison of cast steel and gray iron. Chairman P. T. Bancroft, foundry superintendent, Deere & Co., Moline, Ill., gave a resume of the activities of the association and turned over the gavel to his successor John Dietrich, Blackhawk Foundry Co., Davenport, Iowa. Robert Eichman, Herman Alex and A. D. Ziebarth were named as a committee to arrange for the annual picnic. Owing to an error in the advance notice sent out, the June 1 issue stated that John Howe Hall was to speak at this meeting.

Metal Cost Per Hundred-Weight at the Spout

MATERIALS	Pounds			Hundred-weight
Pig iron	329,461	@ $24.00 G. T. (del'd)	$3,525.23	1.07
Outside scrap	104,600	@ 17.28 N. T. (del'd)	903.74	.864
Remelt	100,020	@ 20.00	1,000.20	1.00
	534,081		$5,429.17	
Coke			594.83	
Limestone			28.83	
			$6,052.83	
PRODUCTION	**Pounds**			
Good Castings	416,000			
Remelt	99,995	@ $20.00	999.95	
Loss	18,086			
	534,081		$5,052.88	$1.214
LABOR			600.00	.144
EXPENSE			518.12	.125
TOTAL AT SPOUT			$6,171.00	$1.483

Protractors Measure Angles

Angles, Triangles, Bevels, Miters and Degrees Discussed and Method Outlined for Measuring the Size of Angles in Degrees

By Walter C. Ewalt

ARTICLES on the various phases of patternmaking occasionally contain references to angles, triangles, bevels, miters and degrees. These five terms are related closely, although a fine distinction exists between each one which should be understood thoroughly by the patternmaker. An angle is the inclosed space near the point where two lines meet. A plane angle is the inclination of two lines to one another in a plane, while a dihedral angle is formed by the intersection of two planes. A solid or polyhedral angle is that made by the meeting at one point of more than two plane angles which are not in the same plane. The word angle also is used to point out the difference between the two lines or sides. The various types of plane angles and their nomenclature may be noted in Fig. 2.

A figure formed by three lines intersecting by twos in three points, and so forming three angles or sets of angles, is called a triangle. The various types of triangles are shown in Figs. 4 to 9 inclusive. As may be noted in the illustration, the equilateral, isosceles and the scalene are classed according to the sides and angles, and the obtuse, acute and right angle triangles are classed according to their angles. Acute angle triangles are shown in Figs. 4, 5, 8 and 9.

Geometry teaches that any side of the triangle may be called the base. However, in an isosceles triangle the base usually is that side which is not equal in length to either of the other two. The base of a right angle triangle usually is considered as one of the sides containing the right angle, and the other side of the right angle is called the perpendicular or altitude. As shown in Fig. 6, the side opposite the right angle is called the hypotenuse. Any of the angular points may be called the vertex, but if one of the sides is designated as the base, the angular point opposite that side usually is called the vertex. More will be said on the subject of angles and triangles in later articles on patternmaking.

Bevel and Miter Joints Differ

A bevel, spoken of in shop terms as a line having a slant, is the angle which one surface or line makes with another when not at right angles. A miter is a joint formed by pieces fitted on a line bisecting the angle of junction. When speaking of joints, some confusion usually exists between the terms bevel and miter, as a bevel often is called a miter and vice versa. Manufacturers of gears make a clear distinction between bevel and miter gears, which probably could be applied to patternmaking. When the angles of the teeth are at 45 degrees, as in Fig. 10, the gear is called a mitergear. If one gear is larger than the other, as shown in Fig. 11, they are called bevel gears and the angle of the teeth of each gear is different. If the same distinction is applied to joints, the joint of two boards of equal width, shown in Fig. 12, is a miter joint.

Two boards of unequal width would be a bevel joint, as shown in Fig. 13. Two boards of equal width, one straight and the other curved, would be a miter joint according to the definition, although the joint is not 45 degrees, as shown in Fig. 14. Would it not be better to call all joints which are cut 45 degrees miter joints and all others bevel joints?

The patternmaker has extensive use for the protractor, which is shown in shown in Fig. 1. This device is manufactured in a number of different styles which may be used by the patternmaker, the one shown being a draftsman's protractor. Usually this tool comes in a combination set with a square and center head, which was referred to in a previous article. Many drawings necessitate angles shown in degrees, and the easiest way to obtain the angles is with a protractor. The lines of division on this device may be understood best by explaining that the circle is divided into 360 equal parts, and one part or 1/360 of the circle is called a degree, which is the unit of measurement. Each degree is subdivided into 60 parts called minutes and each minute is subdivided into 60 parts called seconds. When the seconds are subdivided, they are expressed in decimals of seconds. Each division has an abbreviated sign as 54°—41′—34.25″ or 54 degrees, 41 minutes and 34.25 seconds. The following table should be remembered:

60 seconds equals 1 minute
60 minutes equals 1 degree
90 degrees equals 1 right angle
180 degrees equals 1 semicircle
360 degrees equals 1 circle

The protractor shown in Fig. 1 may be used either side up or on

FIG. 1—A DRAFTSMAN'S PROTRACTOR. FIG. 2—VARIOUS TYPES OF PLANE ANGLES. FIG. 3—THE VERNIER ON THE PROTRACTOR

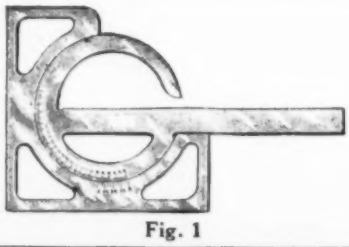
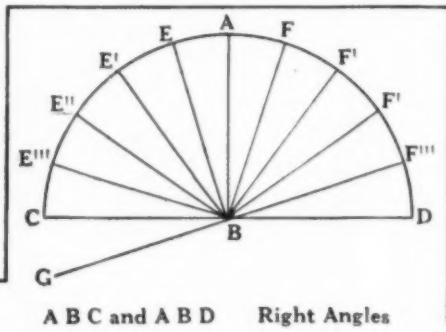


Fig. 1



A B C and A B D	Right Angles
F or F' F'' F''' BD	Acute Angles
E or E' E'' E''' BD	Obtuse Angles
C B D	Straight Angles
GBD	Reflex Angles
B	Vertex Angles

Fig. 2

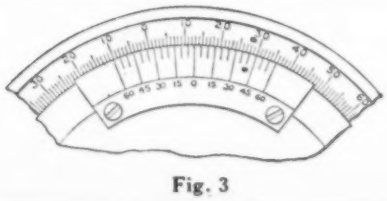


Fig. 3

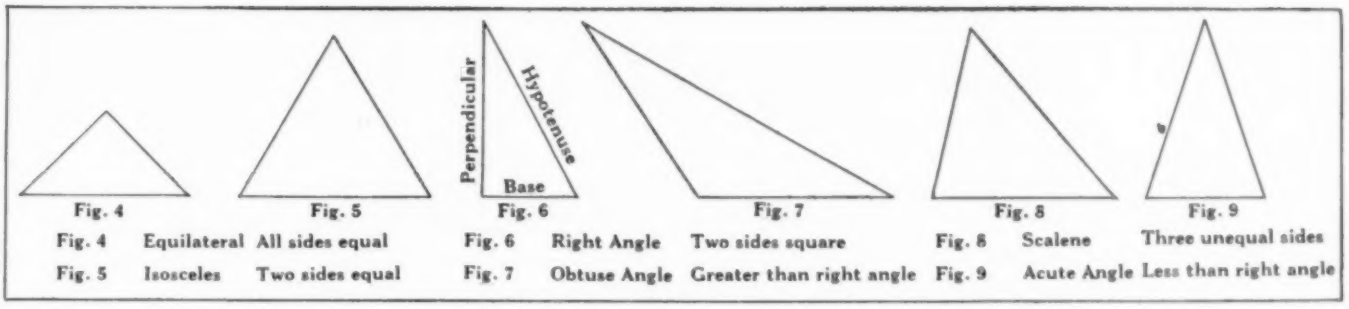


Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8 Fig. 9

Fig. 4 Equilateral All sides equal
Fig. 5 Isosceles Two sides equal
Fig. 6 Right Angle Two sides square
Fig. 7 Obtuse Angle Greater than right angle
Fig. 8 Scalene Three unequal sides
Fig. 9 Acute Angle Less than right angle

either of the two outside edges. With this device the circle may be divided, angles transferred, and a given angle may be laid off without resetting on either side of the line. The protractor has a vernier marking which indicates every five minutes or 1/12 of a degree. The vernier on this protractor differs somewhat from the vernier described in a previous article describing caliper squares. A prominent manufacturer of this type of equipment gives the following directions for reading the vernier: Each space upon the vernier is five minutes shorter than two spaces on the true scale. When 0 on the vernier and 0 on the true scale coincide, the base and the blade of the protractor are parallel. When the swivel head or true scale is moved so that the line on the vernier next to 0 coincides with the line next but one to 0 on the true scale, the inclined angle of the base and the blade has changed 1/12 of a degree or 5 minutes. From the protractor is read directly on the true scale the number of whole degrees between 0 of the true scale and 0 of the vernier scale. Then count in the same direction the number of spaces from 0 to the vernier scale to a line that coincides with the line on the true scale. Multiply this number by five and the product will be the number of minutes to be added to the whole number.

The vernier shown in Fig. 3 has moved 12 whole degrees to the right of the 0 on the true scale as indicated at *. Multiplying 8 x 5 equals 40, the number of minutes to be added to the whole number of degrees, thus indicating a setting of 12 degrees and 40 minutes.

The circle, its divisions and the terms by which they are known often are used in patternmaking. A number of these lines and divisions are shown in Fig. 15. The boundary line of the circle is called the circumference, while every point on the circumference is equal distance from a point within called a center. The arc is any part of the circumference and a chord is a straight line joining the extremeties of an arc. The diameter is a chord which passes through the center of the circle. The radius is ½ the diameter and is a straight line joining the center to the circumference. A segment is the area of that part of the circle cut off by a chord. A sector is that part of a circle included between two radii and the intercepted arc. A tangent is a line touching but not intersecting the circumference.

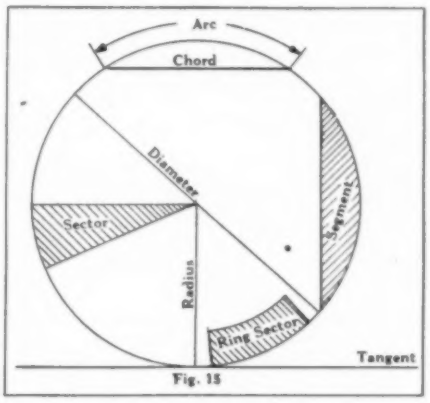


Fig. 15

FIG. 15—NAMES OF THE VARIOUS PARTS OF THE CIRCLE

Two circles of different radii, but with the same center, are called concentric circles. If the circumferences of two concentric circles are joined by two radii, the area contained within is called a circular ring sector. This term often is confused with segment.

The circumference of any circle is nearly 3 1/7 times the diameter. The true value of the ratio cannot be expressed in figures, since when carried to seven decimal places the value is 3.1415926, and so on indefinitely. For all practical purposes sufficient accuracy is obtained by multiplying the diameter by 3.1416 to obtain the length of the circumference.

When laying up flanges and other circular work with circular ring segments, commonly called segments, to make the pattern stronger, the patternmaker first cuts a template. The template is made by laying out two concentric circles and drawing the radii.

If instead of cutting the inside and outside circles, the triangle formed by the two radii and the chord connecting the points on the circumference is cut out, a polygon will be formed when the sectors are joined together. A polygon is defined as a figure having many angles and hence many sides, especially one or more than four angles. The number of angles, angles at the center, angles between adjacent sides, side of the polygon inscribed in a circle, radius of the inscribed circle and the angle of setting stop for polygons ranging from 3 to 12 sides will be shown in the Data Sheet in the July 1 issue of THE FOUNDRY.

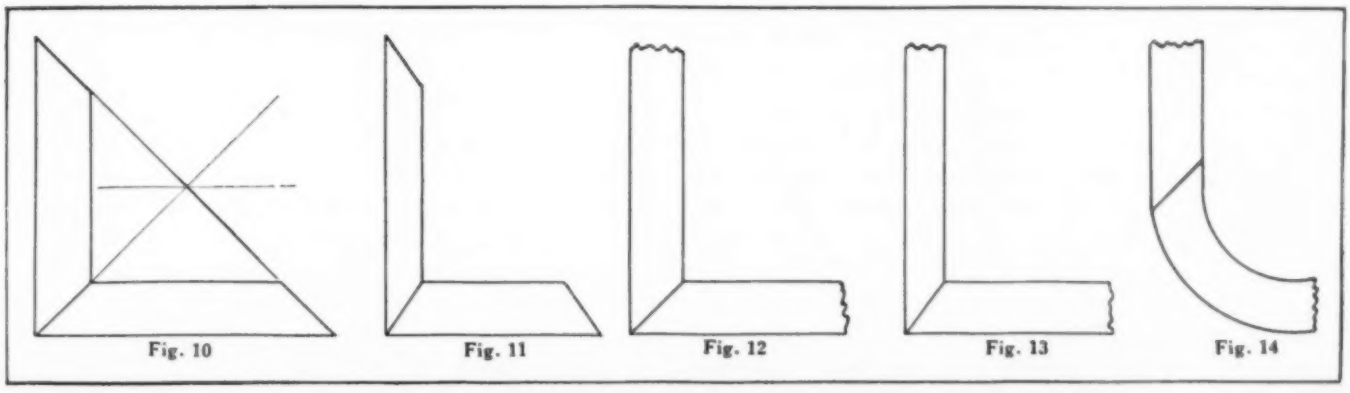


Fig. 10 Fig. 11 Fig. 12 Fig. 13 Fig. 14

FIGS. 10 TO 14—SEVERAL TYPES OF BEVEL AND MITER JOINTS

The Shakeout

DAN M. AVEY, Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶ Seek Light on Lightness

AUTOMOBILE manufacturers are beginning to realize the possibilities of a lighter type of car than is made at present. Every pound of excess weight increases the gasoline consumption and wear on tires. European motor car builders have favored a short wheel-base car that has the feature of light weight with sturdy construction. The popular name for this type of machine is *baby* car—referring to the size of the car and not the application. Recent reports indicate that certain manufacturers in this country are contemplating the production of these *baby* cars.

Edward S. Jordan, Jordan Motor Co., Cleveland, in discussing the automotive industry said that a development of the greatest probable benefit to builders would be an aluminum alloy that will sell for the price of steel. Probably, he referred to the light aluminum alloys since some, like aluminum bronze, are no lighter in weight than steel. The present day tendency is to eliminate any excess weight and the light aluminum alloys are being used to make cast pistons, and forged connecting rods in the motors. In the higher priced cars aluminum crankcases are used exclusively.

IN AIRPLANE manufacture the light alloys are employed to the greatest extent. This is necessary because every ounce of superfluous weight is a decided handicap in flying and weight carrying capacity of the machine. Wrought nonferrous alloys such as, the aluminum-silicon, duralumin, and the aluminum-copper-silicon-manganese alloys are used in the framework of lighter than air craft. Many nonferrous castings of the aluminum base and the magnesium base are used.

For parts lightly stressed and not subject to shocks, such as crankcases, etc., the regular No. 12 aluminum alloy is used. For small parts that can be diecast, this alloy also is used. Little trouble is experienced in casting this alloy and it machines easily. The aluminum-copper-iron-magnesium alloys are used in parts requiring great strength and shock-resistance without resorting to heat treatment. An alloy of aluminum-copper-nickel-magnesium when heat treated is attaining increasing importance as a light material for pistons, cylinder heads and bearings that are used at high temperatures.

Automobile manufacturers have benefited by one innovation first featured on the heavier-than-air craft, namely, the *balloon* tire. What has happened before may happen again. The motor car builder may incorporate aluminum alloys to the same extent as the airplane manufacturer.

¶ Making Easy, But Selling Hard

ASK the average American foundryman about his rate of production and he will answer that for the past three or four years it has been but little above 50 per cent of his capacity. Offer him a profitable contract for castings that will be twice the present capacity of his plant, and he probably will jump at it. He knows that the problem of production is one which he can whip quickly. Go one step further, and ask him if he knows where or how he can sell a sufficient number of castings to step up his present rate of plant operation to 100 per cent, and he is lost.

ALVIN E. DODD, manager of the domestic distribution department of the Chamber of Commerce of the United States in an address delivered to the National Pipe and Supplies association meeting recently said:

> Business has so increased its production capacity that it is becoming more and more apparent that the greatest problem with which it now has to contend is to find the most effective way of disposing of the goods it produces. Unfortunately our knowledge of distribution does not measure up to our knowledge of manufacturing.

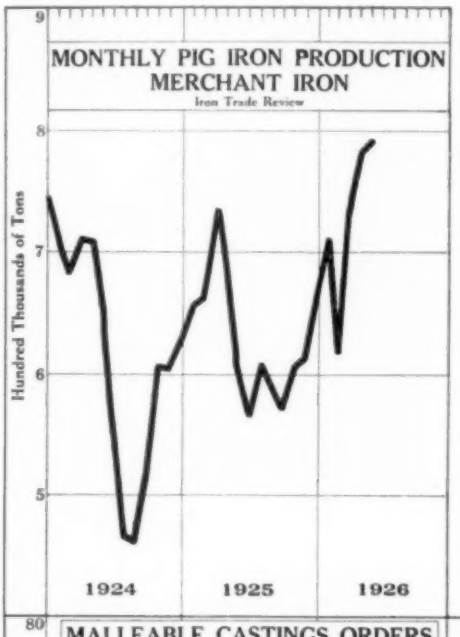
This statement is particularly true as applied to the castings manufacturing industry, which further is handicapped by an absence of production statistics and estimates of normal plant capacity. Perhaps a more detailed census of foundry products would be helpful.

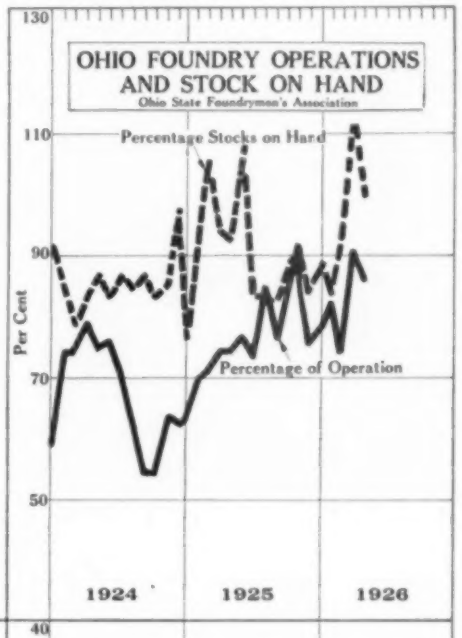
Trade Trends in Tabloid

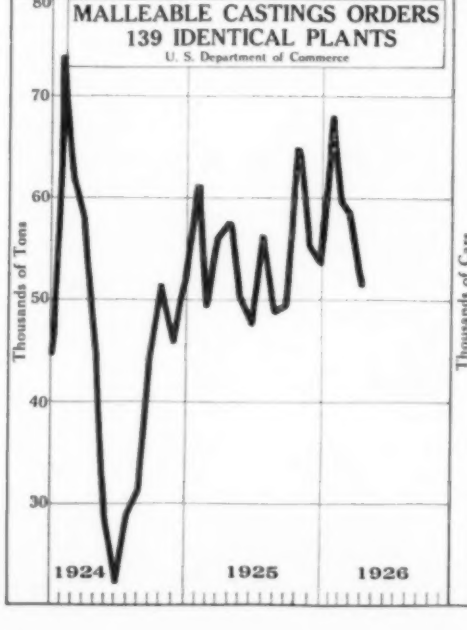
WITH the advent of the summer season, dullness is anticipated in manufacturing lines. This prospect is heightened by the extreme slack buying of railroads, a factor which had been expected to exert an influence in bearing up the summer sag in activity. Conversely, automobile production which was expected to drop away sharply again has upset advance prophecies and seems to be holding a high pace, considering other conditions. In fact April, with its total of 455,842 passenger cars and trucks, as reported by the department of commerce, approaches the record for all time in monthly production. The preceding month's total was 448,081. During May and the first week of June, operations have been spotty. A few manufacturers have been working at capacity, while others have suffered a slight setback. While railway buying is slack, locomotive sales have increased and the unfilled orders for prime movers have been built up. The total production of pig iron for May, according to the *Iron Trade Review* was 3,480,120 tons, compared with 3,438,805 for April. The monthly average New York prices for nonferrous metals in May, according to the *Daily Metal Trade* were as follows: Casting copper, 13.408c; electrolytic copper, 13.865c; Straits tin, 62.54c; lead, 7.78c; antimony, 11.607c; aluminum 98-99 per cent, 27.00c and zinc was 6.811c, E. St. Louis, Ill.

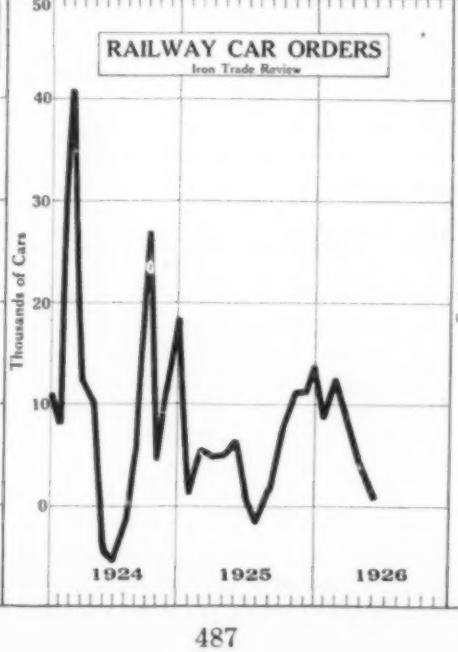
RAW MATERIAL PRICES
JUNE, 8, 1926

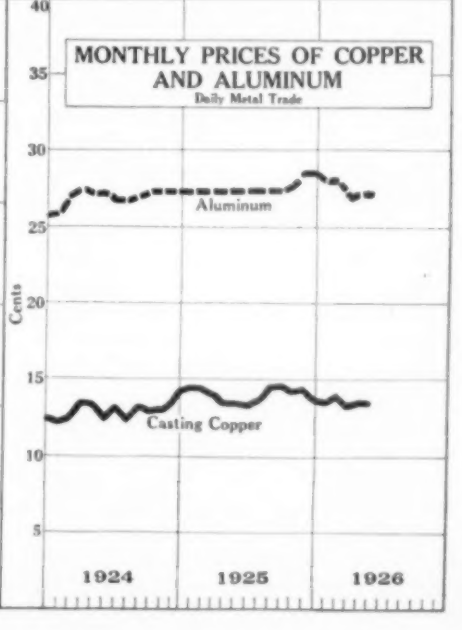
Iron	
No. 2 foundry, Valley	$18.00 to 18.50
No. 2 southern Birmingham	22.00
No. 2 foundry, Chicago	21.00 to 21.50
No. 2 foundry, Philadelphia	22.26
No. 2 foundry, Buffalo	20.00
Basic, valley	18.00
Basic, Buffalo	19.50 to 20.50
Malleable, Chicago	21.00 to 21.50
Malleable, Buffalo	20.00 to 21.00
Coke	
Connellsville foundry, coke	$4.00 to 4.50
Wise County foundry, cake	4.25 to 5.50
Scrap	
Heavy melting steel, Valley	$16.00 to 16.25
Heavy melting steel, Pitts	15.25 to 15.50
Heavy melting steel, Chicago	12.25 to 12.50
Stove plate, Chicago	14.75 to 15.25
No. 1 cast, New York	14.50 to 15.50
No. 1 cast, Chicago	18.00 to 18.50
No. 1 cast, Philadelphia	17.50 to 18.00
No. 1 cast, Pittsburgh	16.00 to 16.50
No. 1 cast, Birmingham	17.00 to 17.50
No. 1 cast, Buffalo	15.75 to 16.25
Car wheels, iron, Pittsburgh	16.50 to 17.00
Car wheels, iron, Chicago	15.25 to 15.75
Railroad malleable, Chicago	16.50 to 17.00
Agricultural, mall., Chicago	15.00 to 15.50
Malleable, Buffalo	16.75 to 17.25
Railroad Malleable Pitts	16.50 to 17.00
Nonferrous Metals	Cents per pound
Casting copper, refinery	$13.30 to 13.35
Electro copper, producers	13.80 to 13.85
Straits tin	58.75
Lead, New York	7.75
Antimony, New York	11.50 to 11.75
Aluminum, No. 12, prod'rs	26.50
Aluminum, No. 12, remelt	24.00 to 24.50
Zinc, E. St. Louis, Ill.	7.00







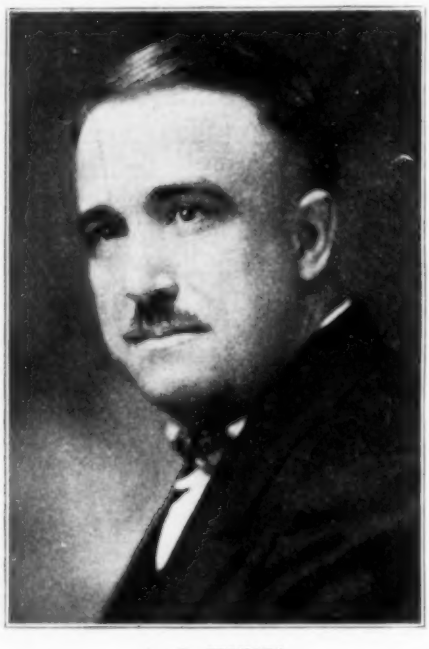




Comings and Goings of Foundrymen

A J. HEYSEL has removed to Australia to take charge of the new malleable foundry of Edward Weir Ltd., Marrickville, N. S. W. For the past three years Mr. Heysel has been superintendent of the Jefferson Union Co., Lockport, N. Y. Previously he was connected with Pratt & Letchworth Co., Buffalo, for five years.

V. C. Faulkner, London, England, has been elected chairman of the



A. J. HEYSEL

Foundry Trades Supplies & Equipment association Ltd.

Albert Shepherd, formerly assistant foundry superintendent, Advance-Rumely Co., Battle Creek, Mich., has been promoted to superintendent.

Albert Rheinemann, foundry engineer, Humboldt, Cologne, Germany, is touring the United States and will inspect foundries and manufacturing establishments in various cities.

W. Jolley, foundry manager, Metropolitan Vickers Co., Ltd., Manchester, England, has succeeded R. O. Stubbs as president of the junior section (Lancashire) of the Institute of British Foundrymen.

D. H. Wood, Birmingham, England, has been re-elected chairman of the Birmingham, Coventry and West Midlands branch of the Institute of British Foundrymen. F. K. Neath replaces H. Roe as honorary secretary.

J. L. Carter, Barlow Foundry, Inc., Newark, N. J, was re-elected president of the Newark Foundrymen's association at a recent meeting. W. H. Mantz, Atlas Foundry Co., Irvington, N. J., was re-elected secretary.

Edward C. Moore, of the Erie City Iron Works, Erie, Pa., was re-elected president of the Erie Manufacturers association at a recent meeting. O. G. Hitchcock, Hays Mfg. Co., is vice president, A. M. Doll, Lowell Mfg. Co., treasurer, and Dana Jones, secretary.

Leon Thomas, director, Fonderies Citroen, Paris, France, has been elected president of the Association Technique de Fonderie. Jean Derdinger, Syndicat General des Fondeurs de France; H. Magdelenat, managing director, Ste. des Usines de Rosieres, and E. Ronceray, Bonvillain & Ronceray were elected vice presidents.

William E. Clegg, general manager Vickers-Commonwealth Steel Products, Ltd., Waratah, N. S. W., Australia, is touring the United States and Canada, inspecting various foundry and manufacturing establishments. He expects to sail for England the latter part of June and spend several months inspecting plants in Great Britain and on the Continent, returning to Australia in December.

Receives Bessemer Award

The council of the Iron and Steel Institute, London, has awarded this year's Bessemer gold medal to Sir Hugh Bell. The medal is awarded as a recognition of outstanding services in the advancement of the art of the manufacture of iron and steel. The presentation of the medal took place at the annual meeting of the institute on May 6, and was made by Sir W. Peter Rylands, the incoming president.

To Discuss Practical Problems At Meeting

A novel feature planned for malleable foundrymen attending the second International Foundrymen's congress at Detroit the week of Sept. 27 to Oct. 1, will be the round table discussion of practical shop problems. The discussion will be informal, following a luncheon, and is planned for the benefit of the practical shop man as well as the metallurgist and executive. Some of the subjects which have been advanced for discussion are as follows: Advantages of Old or New Sand in Making Cores; Methods of Disseminating Scrap Information to Foremen and Molders; Pattern Standardization with a View to Determine the Most Economical Sizes for Bench and Squeezer Jobs; Methods of Avoiding Shrinkage in Malleable Castings and the Extent to Which It is Commercially Feasible To Go in Eliminating Those Faults; Characteristics Which Unfavorably Affect the Machining Qualities of Malleable Castings.

J. L. CARTER

F. L. Wolf, technical director, Ohio Brass Co., Mansfield, O., will preside as chairman of the round table meeting. The regular technical session on malleable iron will be featured by addresses by Enrique Touceda, consultant for the American Malleable Castings association, H. A. Schwartz, research director, The National Malleable and Steel Castings Co., Cleveland, and D. M. Scott, works manager, Symington Co., Rochester, N. Y.

Changes Connection

C. E. Bales has resigned as assistant manager of the Louisville Fire Brick Works Louisville, Ky., to become production manager of the Iron-

ton Fire Brick Co., Ironton, O. Mr. Bales has been active in the firebrick industry in the past few years and is a member of the refractories committee, American Foundrymen's association, and of the research advisory committee, American Refractories institute. He was chairman of the refractories division, American Ceramic society last year and is a member of the committee on tests and specifications of the joint committee to study foundry refractories.

Obituary

Frederick Will Sr., president of the Sterling Range & Foundry Corp., Rochester, N. Y., died in that city rerecently, aged 74. He was born in Rochester, July 19, 1851, and was educated in Germany. For two years he was with Bacon & Will, Toledo, O., retail stove dealer, returning to Rochester to organize the Will Stove Co. On July 2, 1924, the firm name was changed to Sterling Range & Furnace Corp. His three sons, Phillip Will, vice president; Fred K. Will Jr., treasurer, and Walter Will, secretary and sales manager, have been with the company for many years. The late Mr. Will was president twice of the National Association of Stove Manufacturers.

Harvey C. McClary, vice president, Fairbanks, Morse Co., Chicago, died May 30 at his home in Evanston, Ill. He was 78 years old.

J. R. McDonald, an engineer in the employ of the Stephens-Adamson Mfg. Co., Aurora, Ill., died June 2. His death was caused by a heart attack induced by over exertion.

William H. Hall, 66 years old, president of Hall Iron Works, Lockport, N. Y., died, May 25, in that city. He was born in Ithaca, N. Y., March 3, 1860. His father started the ironworks and foundry which he continued.

Charles T. Allen, for many years foundry superintendent of the Schwab & Sercomb Co., now the R. J. Schwab Co., Milwaukee, manufacturer of furnaces and boilers, died, May 25, at the age of 78. He was born in Rochester, N. Y. After serving the Schwab company nearly 30 years, Mr. Allen retired in 1916.

Stanley M. Lawson, 61 years old, president and founder of the National Brass Mfg. Co., Cincinnati, died at his home there recently. Mr. Lawson, who had been engaged in the business for the past 35 years, was the son of F. H. Lawson, pioneer sheet metal manufacturer, who founded the present F. H. Lawson Co., Cincinnati.

Freight Raise Cancelled

Increased freight rates proposed by the railroads on brass, bronze, and copper ingots, pig, scrap and related articles are not justified according to a recent decision by the interstate commerce commission. The rates generally proposed to increase the schedules to the full sixth-class basis with no reductions in schedules, and were to apply between points in official classification territory in the eastern part of the United States.

"The proposed increases," says the report, by Commissioners Esch, Campbell, Cox and Taylor, "appear to be greatest between the Atlantic seaboard and points in central territory, where they are about 50 per cent or more of the present rates. Such marked increases with the smaller increases to points in trunkline territory might disturb seriously the rate relationships upon which the industry has developed."

Will Hold Meeting

The annual election of the Philadelphia Foundrymen's association was held on June 9 at the Manufacturers' club. Walter Wood, R. D. Wood & Co., Philadelphia, has been nominated for president, and C. F. Hopkins, Ajax Metal Co., Philadelphia, for vice president. Nominations for directors are: Walter Wood, chairman; Frederick M. Devlin, C. R. Spare, H. M. Giles, B. H. Johnson, R. R. Bellville and W. L. Kalbach. Oliver Smalley, New York, will speak on recent progress in iron, brass and bronze foundry practice.

Society Elects Officers

The Worcester, Mass., chapter of the American Society for Steel Treating recently elected the following officers: Chairman, Bert A. Davis, Fremont Casting Co.; vice chairman, E. D. Clark, Crompton & Knowles Loom Works; and secretary-treasurer, C. G. Johnson, Worcester Polytechnic institute.

Over $5,000,000 is being expended by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., in constructing new buildings in various sections of the country. Structures or office buildings are in the course of construction at East Pittsburgh, Mansfield, O.; St. Louis; East Springfield, Mass.; Sharon, Pa., and Derry, Pa.

Foundry Association Directory

The Buffalo Foundrymen
Buffalo

President, J. McARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, CHARLES L. LARSEN, Armour Institute of Technology 3200 Federal street, Chicago; secretary-treasurer, E. C. BARRINGER, THE FOUNDRY, 1147 Peoples Gas building, Chicago. Meetings second Saturday in each month at the City Club, 315 Plymouth court.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Foundry Association
New York

President, THOMAS HARPER, Thomas Harper, 204 Lafayette street, New York; secretary, WM. E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry, Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

New England Foundrymen's Association

President, H. P. BLUMENAUER, Arcade Malleable Iron Co., Worcester, Mass.; Secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, CHARLES R. SPARE, Janney Cylinder Co., Holmesburg, Philadelphia; secretary, HOWARD EVANS, J. W. Paxson Co., Luzerne and D street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, WILLIAM K. FRANK, Damascus Bronze Co., South avenue, N. S. Pittsburgh; secretary-treasurer, WM. J. BRANDT, Wm. J. Brandt, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President, J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary-treasurer, W. E. DUNN JR., Healey building, Atlanta, Ga. The 1926 convention to be held at Macon, Ga., the date to be announced later.

Tri-City Technical Council
Moline, Ill.

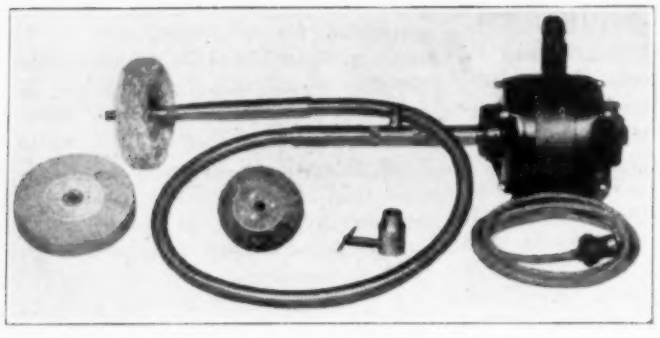
Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

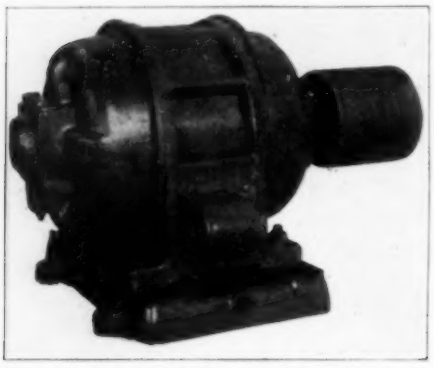
President, J. A. TEACH, Minneapolis Steel & Machinery Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.



A VARIETY OF WORK MAY BE ACCOMPLISHED WITH THIS GRINDER

Grinder Is Portable

A combination tool for drilling, buffing, polishing, grinding, wire scratch brush and other similar operations has been introduced by the Stow Mfg. Co., Inc., Binghamton, N. Y. The tool is driven by a 110-volt,



THE SQUIRREL CAGE TYPE MOTOR IS DESIGNED FOR GENERAL PURPOSES

60-cycle portable motor through a flexible shaft, the motor operating from any light socket. A view of the tool with several attachments is shown in the accompanying illustration.

Makes Changes in Design of Electric Motors

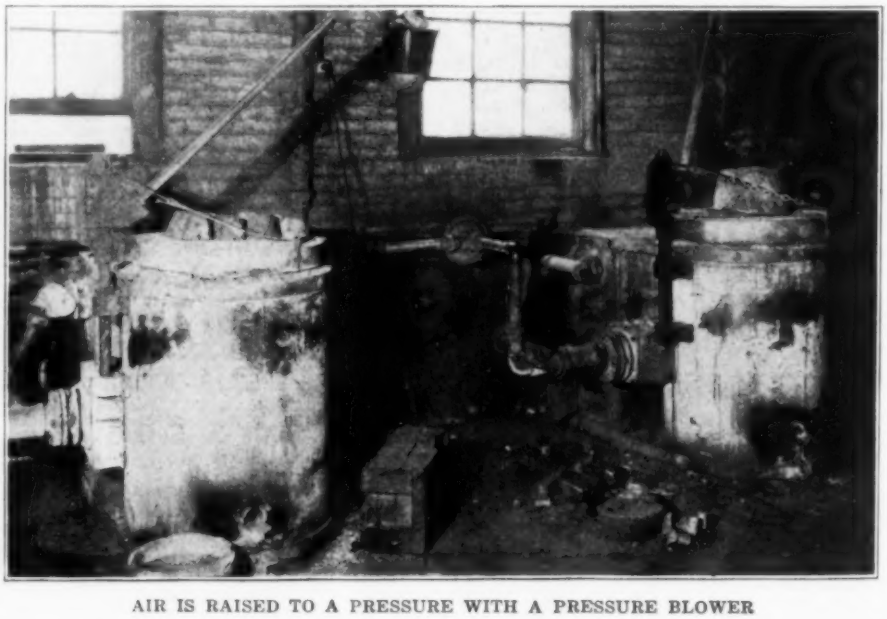
The General Electric Co., Schenectady, N. Y., recently has introduced several new motors of the squirrel cage, wound rotor induction and synchronous types. The squirrel cage type is designed for general purposes where constant speed is required. Refinements which have been made in the new motor of this type include oversize bearings in dust proof housings, and a large supply of oil at a low level.

The wound rotor induction motors may be used either for constant or adjustable varying speed, depending on the type of control used. This type of motor may be used on polyphase circuits where frequent and heavy starting duty is involved, where low starting current is imperative or adjustable, varying speed desired. The synchronous motor is designed for general purposes. In this type standard cast iron skeleton induction motor frames are used, having broad, widely spaced feet cast integral with the frame. Open slot construction is used. The same windings are used for all three power factor ratings. The coils are form wound and insulated heavily. The end shields are the same as on the standard induction motors. Special dust proof and oil tight bearings are used. A view of the induction motor is shown in the accompanying illustration.

Air Is Preheated in Crucible Furnace

A battery of gas fired, recuperative crucible furnaces, developed by the Surface Combustion Co., New York, recently has been installed by the C. A. Goldsmith Co., Newark, N. J. The furnace has a specially designed burner in which air is raised to a pressure of one or two pounds by a pressure blower. Gas, at zero pressure, is inspirated and the air and gas are mixed automatically for complete combustion, which takes place in refractory tunnels. The escaping hot gases are utilized in the recuperator to preheat the air to 900 or 1000 degrees before it is mixed with the gas. A special casting is used under the crucible pedestal through which the cold air passes before it enters the recuperator. A view of the furnace installed at the Goldsmith company is shown in the accompanying illustration.

According to the designing company, the first heat requires from an hour and 20 minutes to an hour and a half. When melting red brass, it is claimed that with the incoming air heated with the waste gases, the fuel consumption is approximately 300 cubic feet per 100 pounds after the furnace has reached the melting temperature.



AIR IS RAISED TO A PRESSURE WITH A PRESSURE BLOWER

Named Managing Director for Fixture Makers

At the recent meeting of the Association for Artistic Decorative Lighting Equipment, formerly the National Council of Lighting Fixture Manufacturers, Granville P. Rogers, New York, was engaged permanently as managing director of the organization, in which position he will direct that body's trade expansion plans. Mr. Rogers for many years was general sales and advertising manager of the Pyrene Mfg. Co., New York, and later was sales manager of the general automotive equipment department of Johns-Manville Inc., New York.

To Sell Brass Property

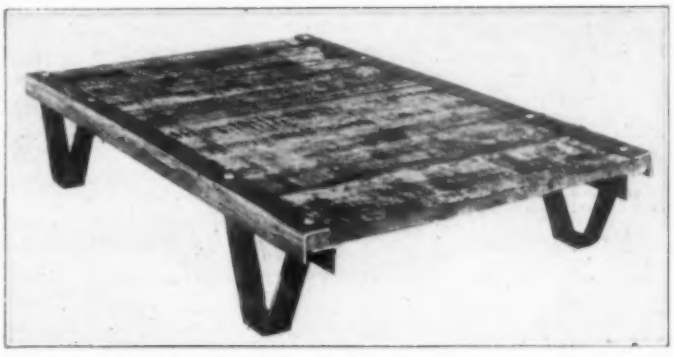
Property and assets of the Unique Brass Mfg. Co., Detroit, will be offered for sale at public auction, June 17. The Security Trust Co., 735 Griswold street, Detroit, is receiver. Property for sale is valued at $428,867.

Compressor Has Direct Connected Motor

The Pennsylvania Pump & Compressor Co., Easton, Pa., has introduced a line of air compressors and vacuum pumps with direct connected synchronous motor drive. The motor rotor is mounted on one end of the crank shaft in place of a belt wheel and the stator is placed close against the frame of the compressor. As may be noted in the accompanying illustration, no extended shaft or outboard bearing is required. To insure steady running of the compressor, a certain amount of fly wheel weight is needed. This is provided by the weight of the rotor on one end of the shaft and by a fly wheel on the other. The fly wheel is approximately the same diameter as the frame of the motor and is mounted on the shaft with a taper fit. The general application of the synchronous motor to these small compressors has been made possible by the development of a system of control, which automatically takes full charge of the starting of the motor from the instant the operator presses the starting button.

Platform Is Built for Heavy Loads

The Stuebing Truck Co., Cincinnati, recently has placed on the market a platform truck which has several interesting features of construction. The principal feature is the method of clamping the wooden top between the jaws of two steel angle rails. It is claimed that this method of clamping gives a vise like gripping action that results in extreme rigidity and strength. This construction also was adopted to secure flexibility, since the platform may be converted into bin types for handling small parts, stake types for long material, rack and table types, etc. The trucks are designed to carry a load as high as 20,000 pounds.

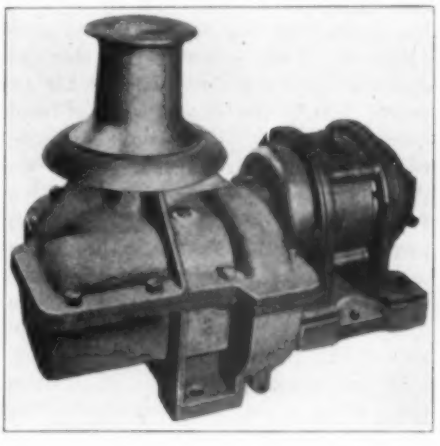


THE PLATFORM MAY BE CONVERTED INTO VARIOUS TYPES TO ACCOMMODATE THE LOAD

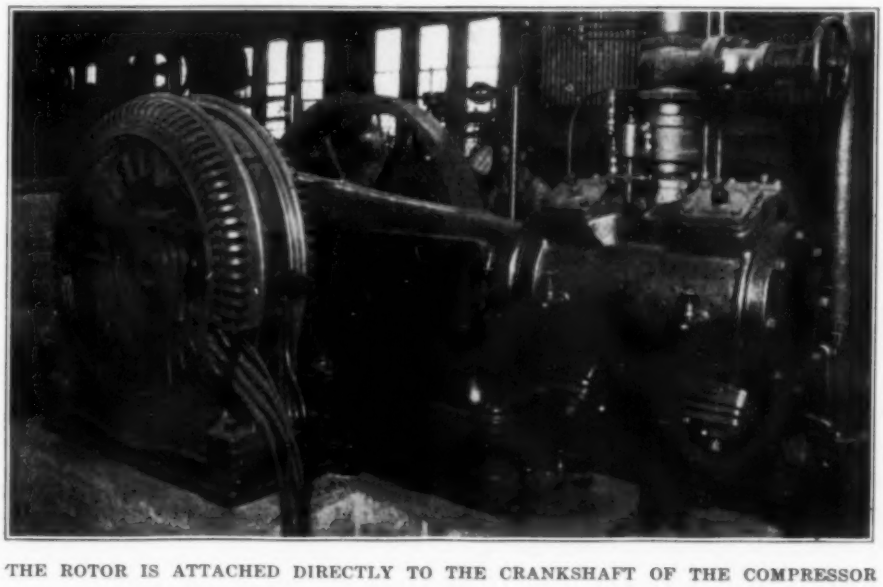
Device Pulls and Spots Railway Cars

The H. W. Caldwell & Son Co., 1700 South Western avenue, Chicago, has placed a machine on the market for moving and spotting cars, which differs in a number of respects from the line previously manufactured by that company. The unit is built in two sizes, one with a speed of 40 to 60 feet per minute while moving one, two or three cars, and the other with a speed of 26 to 42 feet per minute moving from three to six cars. The upper bearing of the vertical capstan shaft is especially long to take the pressure from the rope pull. The capstan has a large flange on the lower edge which fits over the end of the bearing to reduce the bending moment of the shaft.

A cut steel spur pinion mounted on the motor shaft meshes with a cut cast iron spur gear on the worm shaft. The worm is of hardened steel, integral with the shaft, and runs on roller bearings. A ball bearing takes up the end thrust. The bearings are mounted on a frame which is bolted to an iron center. A bronze thrust washer is located between the hub of the worm gear and the lower bearing of the vertical shaft. The device has a special automatic oiling system. The machine and motor are shown in the accompanying illustration.



THE MOTOR-DRIVEN MACHINE IS BUILT IN TWO SIZES



THE ROTOR IS ATTACHED DIRECTLY TO THE CRANKSHAFT OF THE COMPRESSOR

Company Is Incorporated

The Bierwirth Pattern Works, Detroit, has been merged and now is the Mid West Pattern & Mfg. Co. The incorporators are C. Bierwirth who has operated the first named jobbing shop for many years and Frank Evans, formerly superintendent of patterns and foundry, Hupp Motor Car Co., for 12 years. Mr. Bierwirth is president and Mr. Evans is vice president and treasurer of the new firm.

Will Hold Convention

The Association for Artistic Decorative Lighting Equipment will hold its annual general convention in Montreal, Can., from June 23 to June 26. Matters of interest to the trade and the establishment of a national exhibition will be discussed.

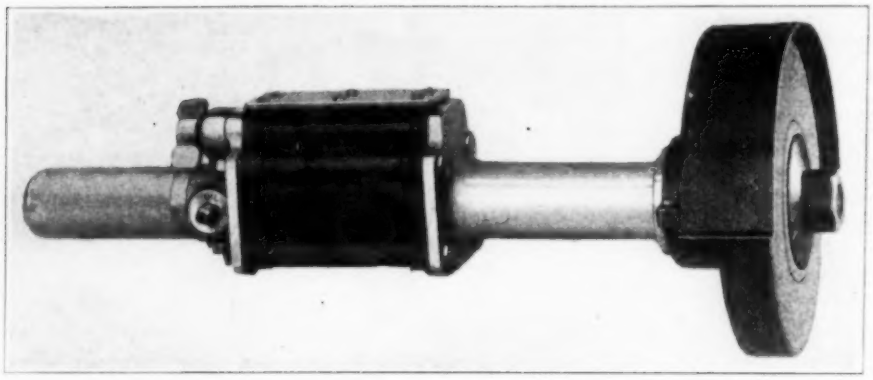


FIG. 1—THE GRINDER MAY BE OPERATED AT 4000 REVOLUTIONS PER MINUTE

Make Changes in Air Grinder Design

The Warner & Swasey Co., 5701 Carnegie avenue, Cleveland, recently has made a number of changes in the design of its line of pneumatic grinders. The motor is of the two cylinder type. An eccentric rotor revolves inside the inner wall of each cylinder, which is bored perfectly round. The rotors are keyed to the shaft indirectly opposite position. When the rotor on one cylinder is in position for exhaust, the rotor on the other cylinder is in position directly opposite, and at the midpoint on the upward power stroke. This prevents any possibility of the grinder stopping on center. It also is claimed that this gives the motor perfect balance, producing an even flow of power without vibration.

The clearance between the rotor and the cylinder is sufficient to prevent wear on these parts. An oil film seals this clearance to prevent leakage of air between the rotor and the cylinder walls. A large ball bearing mounted between the two cylinders centralizes the rotor assembly. The oil reservoir in the handle holds sufficient lubricant for from six to ten hours continuous operation. The oil enters the motor with the incoming air and may be regulated with an adjustable needle valve.

In Fig. 2, *A* is the cylinder, *B* is the exhaust port, *C* is the rotor blade, *D* is the spindle, *E* the cylinder cap, *F* the intake port and *G* the rotor. In the drawing at the left of Fig. 2, the intake port is shown in position for the air to enter and exert a downward pressure on the rotor blade? This pressure starts the rotor on its cycle. The cycle is shown half completed in the center drawing, and the rotor is on the upward power stroke. In the illustration at the right, the cycle is completed and the air is leaving through the exhaust ports.

The grinder is built in several models, the one shown in Fig. 1 using about 30 cubic feet of air per minute. It may be speeded to 4000 revolutions per minute. This type carries a wheel 6 inches in diameter and with a 1-inch face.

Investigates Changes in Character of Iron

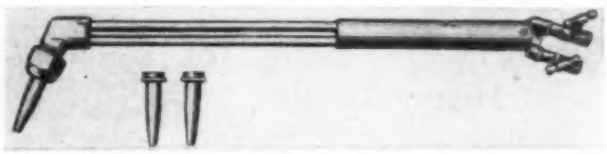
Results of an investigation recently carried on by the bureau of standards did not confirm the existence of the reported transformation point in pure iron at 698 degrees Fahr. However, an irregularity in the thermal characteristics of iron were indicated which appeared in the thermal analysis as an evolution of heat upon heating. It is shown best in iron containing appreciable amounts of oxide that has been treated with hydrogen. The presence of hydrogen is not believed to be the cause of the phenomenon. A suggested explanation of the irregularity is the recrystallization of the reduced iron. X-ray examination indicated a much finer grain for iron formed in this manner than for ordinary iron. The practical value of the investigation is to show the physical metallurgist that diagrams for any iron alloy system need not be made any more complicated than they already are because of this reported transformation point.

Pulley Blocks Use Steel

Universal System of Machine Molding & Machinery Co., Ltd., 97 Queen Victoria street, London, E. C. 4, recently has introduced a line of straight geared pulley blocks. Compactness is a special feature claimed for these pulley blocks which are made entirely forged or rolled steel. The pulleys are made in sizes ranging from 500 pounds to 32 tons in capacity.

Builds Small Torch

A special small welding torch, which may be applied to work not requiring the usual standard torch, recently has been introduced by the Alexander Milburn Co., Baltimore. The torch uses the same tips as the larger standard torches. The new torch is adapted to gas supplied either from generators or compressed air tanks and is made of bronze forgings and specially drawn stainless tubing. The torch is 18 inches long, weighs 25 ounces, and is supplied with three welding tips adaptable to a wide range of welding.



THE TORCH IS ADAPTABLE TO A WIDE RANGE OF WORK

Shovel Works To Build

The Wyoming Shovel Works, Wyoming, Pa., has awarded a contract to the Austin Co., Cleveland, for the design and construction of a new building to replace a structure recently damaged by fire. The building will be 100 x 200 feet. A large dry kiln also is to be installed.

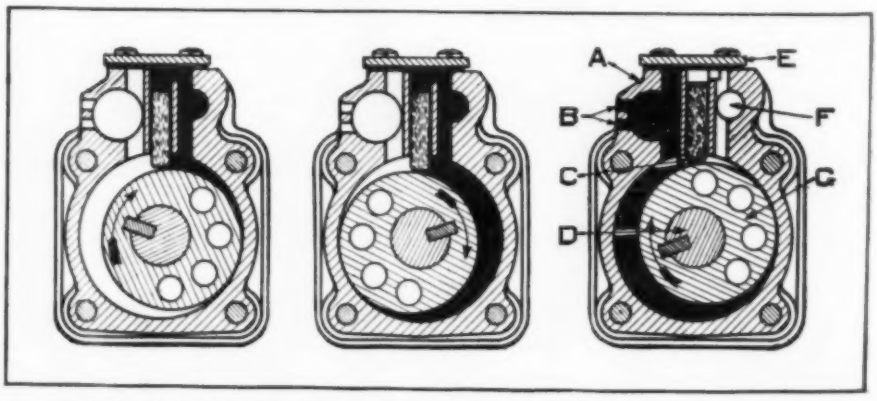


FIG. 2—END VIEW OF CYLINDER SHOWING PRINCIPLE OF OPERATION

Summer Sales Slump Is Slight

May Business Was on High Level and Inquiries Point to Continued Buying of Equipment in Many Quarters

ALTHOUGH the volume of sales of foundry equipment has fallen off slightly since the first of the month in several distributing centers, the decline has not been as great as in several years past. Business closed in May was rather high with a number of manufacturers in the Cleveland territory, and one builder secured more business in that month than in any month in the past six years. Inquiries are holding up well in that territory, and men of the trade are not anticipating any marked recession.

While sales in the Pittsburgh territory are not numerous, they have kept up well considering the lull in business, and the fact that inquiries are being brought out in large numbers promises well for the future. Equipment demand in New England has been quiet during the past two weeks, and little has been placed except molding machines and sand mixing equipment.

A fairly large number of melting units has been placed recently in the eastern district, one manufacturer having sold seven individual cupolas. At the same time several units are being figured actively including two or three electric furnaces. Sales of foundry equipment in May were fair in the Chicago district, the latter half making up for the slump earlier in the month. June has opened little better, although some action is noted from shops in Wisconsin.

Sales of foundry equipment in April declined 10 per cent compared with March and gained 19 per cent over April last year according to a recent report of the Foundry Equipment Manufacturers association. The sales in April totaled $434,626 as compared with $483,010 in March and $362,527 in April, 1925. Shipments for the month were valued at $402,494 as compared with $525,655 in March and $327,796 the corresponding month a year ago. Orders on hand May 1 were valued at $506,214 as compared with $504,671 on April 1 and $539,232 on May 1, 1925. Orders on hand May 1 were 6 per cent less than for the same month a year ago.

Exports of foundry and molding equipment in April showed a remarkable increase according to a report of the department of commerce. The value of exports in April was $154,407 as compared with $51,735 in March and $95,705 during April, 1925. The value of exports for the ten months ended April 30 was $610,733 as compared with $536,166 during the corresponding period a year ago.

NEW ENGLAND MARKET

Dust Arrester Equipment

Draper Corp., Hopedale, Mass.; Riley Stoker Corp., Worcester, Mass.; from the W. W. Sly Mfg. Co., Cleveland.

Furnaces

Taunton-New Bedford Copper Co., Taunton, Mass., cupola equipment; Plainville Casting Co., Plainville, Conn., cupola equipment; from the J. W. Paxson Co., Philadelphia.

Molding Machines

Taylor & Fenn, Hartford, Conn., three; Walworth Mfg. Co., South Boston, Mass., two; Mansfield Foundry Co., Mansfield, Mass., two; from the Tabor Mfg. Co., Philadelphia.

Sandblast Equipment

Reed-Prentice Co., Worcester, Mass.; from the J. W. Paxson Co., Philadelphia.

Waterbury Mfg. Co., Waterbury, Conn.; Safety Car Heating & Lighting Co., New Haven, Conn.; General Electric Co., West Lynn, Mass.; from the Pangborn Corp., Hagerstown, Md.

Draper Corp., Hopedale, Mass., mill and rotary table; from the W. W. Sly Mfg. Co., Cleveland.

Sand Preparing Equipment

Mansfield Foundry Co., Mansfield, Mass.; Turner & Seymour Mfg. Co., Torrington, Conn., Ford & Kimball, Concord, N. H.; sand separator and blender; from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Crompton & Knowles Loom Works, Worcester, Mass., mixer; from the National Engineering Co., Chicago.

PITTSBURGH MARKET

Core Ovens

Westinghouse Electric & Mfg. Co., Linhart, Pa., oven equipment; Union Switch & Signal Co., Swissvale, Pa., oven equipment; Conemaugh Iron Works, Blairsville, Pa., two units; from the Foundry Equipment Co., Cleveland.

Dust Arrester Equipment

Pittsburgh Plate Glass Co., Pittsburgh; Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; from the Pangborn Corp., Hagerstown, Md.

Furnaces

Murry Co., Atlanta, Ga., one cupola; from the Whiting Corp., Harvey, Ill.

Joseph Painter & Sons, Myerstown, Pa., cupola equipment; from J. W. Paxson Co., Philadelphia.

Ladles

Kutztown Foundry & Machine Co., Kutztown, Pa., geared ladle crane; from J. W. Paxson Co., Philadelphia.

Sandblast Equipment

Coxe Traveling Grate Co., Port Carbon, Pa.; Confer Smith & Co., Inc., Hamburg, Pa.; Freed Furnace Co., Oaks, Pa.; from the J. W. Paxson Co., Philadelphia.

Pittsburgh Plate Glass Co., Pittsburgh; Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; from the Pangborn Corp., Hagerstown, Md.

Shakeout Equipment

Westinghouse Air Brake Co., Wilmerding, Pa., shakeout bail; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

CLEVELAND MARKET

Dust Arrester Equipment

Packard Motor Car Co., Detroit; from the Pangborn Corp., Hagerstown, Md.

Furnaces

National Foundry Co., Erie, Pa., one 1-ton electric; from the American Bridge Co., Ambridge, Pa.

Ladles

Fillmore Ave. Foundry & Iron Works, Buffalo, 5-ton helical worm geared; from the Whiting Corp., Harvey, Ill.

Molding Machines

Ferro Machine & Foundry Co., Cleveland, 6 jolt squeeze strip and 16 vibrator table type; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Sandblast Equipment

Dodge Bros., barrels; from the J. W. Paxson Co., Philadelphia.

Packard Motor Car Co., Detroit; from the Pangborn Corp., Hagerstown, Md.

Sand Preparing Equipment

Erie Forge Co., Erie, Pa.; Kuhns Bros. Foundry, Dayton, O., sand separator and blender; from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Shakeout Equipment

Wessling Bros., Cincinnati, shakeout bail; U. S. Radiator Corp., Detroit; Griffin Wheel Co., Detroit; Ferro Machine & Foundry Co., Cleveland, vibrator and shakeout equipment; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Tumbling Barrels

Wadsworth Foundry Co., Wadsworth, O., one; from the Whiting Corp., Harvey, Ill.

Gartland-Haswell-Rentschler Foundry Co., Dayton, O., two; Pittsburgh Valve & Fitting Co., Barberton, O.; from the W. W. Sly Mfg. Co., Cleveland.

CHICAGO MARKET

Cranes

International Harvester Co., Rock Island, Ill., for 2-ton electric, from H. D. Conkey Co., Chicago.

Dust Arrester Equipment

Maytag Co., Newton, Iowa; from the Pangborn Corp., Hagerstown, Md.

Studebaker Corp., South Bend, Ind.; Ypsilanti Foundry Co., Ypsilanti, Mich., from the W. W. Sly Mfg. Co., Cleveland.

Furnaces

General Boilers Co., Waukegan, Ill., one cupola; Koken Co., St. Louis, one cupola; Waukegan Foundry Co., Waukegan, Ill., one cupola; from the Whiting Corp., Harvey, Ill.

Ladles

International Harvester Co., Chicago, eight 1500-pound; Robinson-Carey-Sanda Co., St. Paul, three bottom tapped; Pettibone-Milliken Co., Chicago, one 9500-pound helical worm geared; from the Whiting Corp., Harvey, Ill.

Molding Machines

Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill., one; Dedman Foundry & Machine Co., Houston,

Tex., one; from the Herman Pneumatic Machine Co., Zelienople, Pa.

Sandblast Equipment

Allis-Chalmers Mfg. Co., Milwaukee; Minneapolis Steel & Machinery Co., Minneapolis; Crane Co., Chicago; from the Pangborn Corp., Hagerstown, Md.

Ideal Foundry Co., Grand Rapids, Mich., mill; from W. W. Sly Mfg. Co., Cleveland.

Sand Preparing Equipment

Ypsilanti Foundry Co., Ypsilanti, Mich.; Baker Perkins Co., Saginaw, Mich.; Electric Household Utilities Corp., Waukegan, Ill.; sand separator and blender; from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Shakeout Equipment

Crane Co., Chicago; International Harvester Co., Chicago, shakeout bails; Columbia Sanitary Mfg. Co., Louisville, Ky.; Pullman Co., Pullman, Ill.; Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill.; Wilson Foundry & Machine Co., Pontiac, Mich.; Studebaker Corp., South Bend, Ind.; Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., vibrator and shakeout equipment; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Tumbling Barrels

International Harvester Co., Chicago, two, from the Whiting Corp., Harvey, Ill.

NEW YORK MARKET

Core Ovens

DuPont Engineering Co., Wilmington, Del., oven equipment; from the J. W. Paxson Co., Philadelphia.

Dust Arrester Equipment

Elmira Foundry Co., Elmira, N. Y.; from the W. W. Sly Mfg. Co., Cleveland.

Gould Pump Co., Seneca Falls, N. Y.; from the Pangborn Corp., Hagerstown, Md.

Furnaces

Ajax Car Products Co., Cumberland, Md., one cupola; A. Weiskittle & Sons Co., Baltimore, one cupola and auxiliary equipment; Power Specialty Co., Dansville, N. Y., one cupola; from the Whiting Corp., Harvey, Ill.

Olney Foundry Co., Philadelphia, one cupola; William Schofield Co., Philadelphia, one cupola; More Bros. Co., Elizabeth, N. J., one cupola; Geneva Foundry Co., Geneva, N. Y., one cupola; from the J. W. Paxson Co., Philadelphia.

Sandblast Equipment

Continental Heater Corp., Dunkirk, N. Y.; Andes Range & Furnace Corp., Geneva, N. Y.; from the Pangborn Corp., Hagerstown, Md.

Sand Preparing Equipment

American Radiator Co., Black Rock, N. Y., sand separator and blender; from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Tumbling Barrels

Joseph A. Vogel Co., Wilmington, Del.; Hart & Crouse Co., Utica, N. Y., from J. W. Paxson Co., Philadelphia.

Smith & Wellstood, Ltd., Bonneybridge, Scotland, five; Ste. An. Andre Citroen, Paris, France, one continuous type; Elmira Foundry Co., Elmira, N. Y., two; Coldwell Lawn Mower Co., one; from the W. W. Sly Co., Cleveland.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

A. P. Schraner, 3338 Payne avenue, Cleveland, manufacturer of patterns and tools, will build an addition to his plant.

American Hoist & Derrick Co., 63 South Robert street, St. Paul Minn., has had plans made for a 1-story machine shop.

William Powell Co., Cincinnati, George McFarlan president, is having plans made for a foundry at 2521 Spring Gorve avenue.

Delco Light Co., Dayton, O., E. G. Beichler president, is considering plans for additions to its plant.

Pittsburgh Pipe & Foundry Co., Henryetta, Okla., has increased capital from $50,000 to $100,000.

Santa Rosa Brass & Bronze Foundry Co., Santa Rosa, Calif., has completed its new plant in a suburb.

Cape Girardeau Foundry Co., Cape Girardeau, Mo., has been incorporated with $50,000 capital by B. E. White and J. Desloge.

Manitoba Steel Foundries, Selkirk, Man., suffered loss by fire which will be rebuilt at once.

J. H. Day Co., 3256 Spring Grove avenue, Cincinnati, has let contract to T. Hirschfeld, for a 1-story addition to its machine shop.

Abingdon Sanitary Mfg. Co., Abingdon, Ill., has let contract to F. L. Borer for three additions to its plant.

Western Land Roller Co., Hastings, Nebr., has let contract to Edward Green Construction Co. for factory, offices and foundry, one story, 120 x 370 feet.

Price Brothers & Co., Ltd., Kenogami, P. Q., Canada, are contemplating construction of additions to their present gray iron and brass foundry.

F. S. Lang Mfg. Co., Seattle, manufacturer of stoves, is adding a kitchen equipment apartment for the manufacture of steam tables, bakery cabinets and other equipment.

Landers, Frary & Clark, New Britain, Conn., manufacturers of hardware, will bulid a 6-story addition and a smaller building to increase production.

General Automotive Corp., Indianapolis, recently incorporated, will begin manufacture of anti-slap pistons for automobile motors, under rights acquired from the Anti-Slap Piston Co., Rahwah, N. J. William M. Fogarty and Eugene M. Gogarty are directors.

Chicago Pneumatic Tool Co., Chicago, Cary C. Vanden Boom, district manager, 572 West Randolph street, will build a 2-story plant 50 x 260 feet.

Josam Mfg. Co., Michigan City, Ind., J. Hirschtein president, 4900 Euclid avenue, Cleveland, has let contract to H. K. Ferguson Co., Cleveland, for a 1-story foundry 60 x 128 feet.

Gordon Pattern Mfg. Co., Cleveland, manufacturer of wood and metal patterns, has moved into its new plant at East 152nd street and Coit avenue.

American Seating Co., Grand Rapids, Mich., has given contract to Owens-Ames-Kimball Co. has been given contract for three additional buildings for its plant here. (Noted May 1).

Fuller-Warren Co., Milwaukee, manufacturer of stoves and ranges, H. A. Viets president and general manager, is building an addition 200 x 300 feet for enameling and finishing shop.

Piston Ring Co., 500 Sanford street, Muskegon, Mich., Charles E. Johnson president, has let contract to the Strom Construction Co., Grand Rapids, for a 4-story addition 120 x 126 feet. (Noted April 15.)

Springfield Malleable Iron Co., Springfield, O., T. W. Ludlow president, 37 Bechtle avenue, has let contract to Bellefontaine Bridge & Iron Co. for four factory buildings to replace fire loss.

Clark Bros. Co., Olean, N. Y., Joseph S. Reidy president, manufacturer of sawmill machinery, has plans for a foundry 46 x 96 feet, a machine shop 100 x 125 feet, toolhouse 40 x 90 feet.

Moore & Steel Corp., New York, has been incorporated with 100 shares common no par value to operate an iron foundry by P. Smith, A. F. VonBernuth and A. O. Dawson. Rearick, Dorr, Lewis & Marshall, 61 Broadway, are attorneys.

Durable Products Co., Packard building, Philadelphia, has been incorporated with $5000 capital to manufacture heat treating and coating machinery, galvanizing machinery and castings, by H. H. Evans, Moorestown, N. J., C. W. Edgerton, Haverford, Pa., and George M. Leathem, 4918 Osage avenue, Philadelphia.

The Manhattan Brass Co., New York, is discontinuing business with the sale of its properties which were sold a few weeks ago. The equipment and metals were sold at public auction June 10 and 11. The company manufactured sheets, tubes, rods and wire. It also did casting and spinning, and machined iron and steel parts for its products.

New Trade Publications

ELECTRIC METERS—A bulletin of a series giving instructions for installation, operation and application of its meters has been issued by the Sangamo Electric Co., Springfield, Ill., covering its watthour meter. Illustrations cover details of construction, diagrams show its layout and connections.

REFRACTORIES—Co-operation between maker and user of fire brick, if best results are to be obtained, is the message in a leaflet on fire brick issued by the Ashland Fire Brick Co., Ashland, Ky.

CONVEYORS—Moving materials in various containers, loading or unloading, piling and tiering are described in a well-conceived catalog by the Standard Conveyor Co., North St. Paul, Minn. A wide diversity of duty possible by the equipment made by this company is shown in the illustrations and in the text is much information as to savings over manpower for the same purpose.

AIR FILTERS—Automatic removal of dust from air by passing through screens coated with a viscous material, which are self-cleaning, is described in a bulletin by Drying Systems Inc., Chicago. Representative installations are shown and advantages of this means of cleaning air for business houses and plants are presented.

ELECTRIC RELAY—An across-the-line-relay is described in a bulletin by the Allen-Bradley Co., Milwaukee. A feature is provision for changing the relay rating by moving the position of the core.